ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAFER

ESTABLISHED 1872

Vol. CXLV. No. 3761

23rd DECEMBER, 1949

Power Station Unrest

FAULTS ON BOTH SIDES

LAST week's "unofficial" power station strike was born of impatience and misunderstanding. It was sustained by what seems to have been tactlessness on one side and supersensitivity on the other. In fact, the whole busines seems to have been rather badly handled and only the Government comes out well for taking immediate steps to maintain a supply from the stations involved.

Origin of Strike

Up to May last extra rates had been paid to compensate men in the three stations—Brimsdown, Taylor's Lane (Willesden) and Littlebrook—for onerous conditions. The British Electricity Authority considered (and the trade unions concurred) that while the additional payments may have been necessary once, the conditions now prevailing did not justify them in general. Nevertheless, they were not actually withdrawn but were "merged" in the all-round increase of 1½d an hour granted from 1st June. It was recognized that special cases warranting special payments should be the subject of negotiation.

Although the B.E.A. and the Electrical Trades Union insisted that nobody would suffer monetary loss, the "differential" largely disappeared and this was naturally unpalatable. The situation was not improved by the impression gained by the strikers that the negotiating machinery was not dealing with the special cases quickly enough. It certainly seems as though that "machinery" (a deplorable word) may be too heavy and complicated. It is possible that in attempting to give fair representation to all interests at all "levels" too elaborate a structure is being erected.

A joint pronouncement made by the B.E.A. and the trade unions stated that there had been a unanimous decision by the National Joint Industrial Council on the issues raised at the three power stations. Certain details remained for settlement and arrangements had been made for these to be attended to "quickly and fairly." A meeting had been called for Thursday last week between trade union representatives and their "rank and file members." Yet the matter has been hanging fire since last June.

Delayed Return

The strike was actually called off on Thursday but was immediately resumed when it was found that notices had been posted telling the men that their return was "unconditional." This unwise piece of officialism, reminiscent of the "unconditional surrender" of wartime, upset the strikers, who thought they saw in it an abrogation of previous agreements. Finally a new notice was substituted to explain that "unconditional" really meant a return on the conditions already prevailing, and the strike ended.

It is necessary to come to the conclusion that there is not yet full confidence in the industry's negotiating machinery because its operations are not understood and are too slow. If the long-

standing good relations which the B.E.A. inherited are to continue the Authority and the trade unions must see that the system is simplified, properly explained and speeded up. The failure of the strikers to bring about a stoppage in stations throughout the area or the country suggests that a good disposition still exists generally. Care must be taken that it is not destroyed.

LOAD FLOW

THOSE who have to design power supply networks frequently find that the arithmetic involved is apt to become very cumbersome. The article entitled "Load Flow Calculations" presented on a subsequent page describes what is believed to be an original approach to the solution of this type of problem. The method here developed has not, so far as is known, been previously published. Its employment should result in a considerable saving of time, by comparison with the more orthodox procedure.

ELECTRIC TRANSPORT

AT the May luncheon of the Electric Vehicle Association, Sir Cyril Hurcomb, chairman of the British Transport Commission, said that British Railways were devoting particular attention to the evolution of an electrically driven "mechanical horse" and two prototypes had been produced. An announcement by British Railways now shows that tests in service are now proceeding on three types of electric "horse" and four electric parcels vans. There is undoubtedly great scope here for electric vehicles, which are economical in running and maintenance charges. It is to be hoped that the Post Office and other national bodies will keep an eye on the results and follow British Railways' example.

COMPETING IN AMERICA

SOME British manufacturers are not too sanguine of disposing of their products in the United States, but dollars might be earned by British subsidiaries of American companies, it is thought by the *Anglo-American News*, the official organ of the American Chamber of Commerce in London. With devalued sterling it seems possible that the manufacturing costs of these subsidiaries might prove to be substantially lower, especially for such articles or parts which do not lend themselves very readily to mass-production methods and consequently include a heavy percentage of labour costs. This argument could also be applied to producers who are not American subsidiaries but, of course, the market would not be ready-made for them.

PATENTS LAW

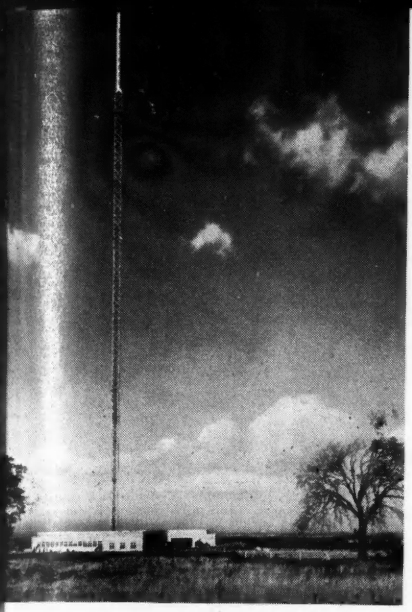
THE removal of legislative anomalies, consolidation of existing relevant laws and statutory regulations into a single unified code, is one only of the several objects of the Patents and Designs Act, 1949, which becomes operative on January 1, 1950, when all patents, designs and trade mark litigation is transferred from the Law Courts to H.M. Patent Office Court. The new Act also charges the Comptroller-General with the responsibility for exploiting inventions of merit in conjunction with the newly established National Research Development Corporation. The Act assigns to the Comptroller the power to acquire, compulsorily if need be, dormant patents thought to be capable of benefiting the country as a whole.

I.E.E. PRESIDENT'S APPEAL

IT has become customary for the president of the I.E.E. at this time of year to remind the membership of the Benevolent Fund. May the response to Prof. E. B. Moullin's appeal for donations be really big, so that with that hope may be coupled a suggestion to make the gift a two-part one, to the Benevolent Fund and to the Homes Fund. The number of donors to the latter has increased slightly, but a little less than half the sum required to provide homes on the New Malden estate in Surrey is all that has been subscribed so far.

SEASON'S GREETINGS

WE extend our best wishes for Christmas and the coming year to all our readers and our thanks to the many who have sent us cards, calendars and diaries. May 1950 see an easing of the economic situation both national and personal.



The transmitter building and 750ft mast at the new Sutton Coldfield television station

Midlands Television Service

Equipment of the New Sutton Coldfield Station

WITH the opening of the Sutton Coldfield television transmitting station on Saturday last by the Postmaster-General the first step was taken in the extension of television to the whole country. It is estimated that the station will add a further six million to the potential television audience.

This station, which is the most powerful of its kind in the world, is on a 24-acre site about ten miles to the north of Birmingham and is 550ft above sea level. Near the centre of the site is the L-shaped station building in which are installed the sound and vision transmitters, control room and power supply arrangements. A 750ft steel mast, built by British Insulated Callender's Cables, Ltd., supports the combined television and sound aerials and it is the tallest mast so far erected for the B.B.C.

There are no studios, for Sutton Coldfield is solely a transmitting station and takes its programmes from the London station at Alexandra Palace. The vision programme signals are sent from London to Birmingham over the u.h.f. radio link

The transmitter hall. In the foreground of the picture is the vision transmitter, and beyond this the sound transmitter. To the left of the hall, through the curved window, is the station control room

(see *Electrical Review*, 11th November, page 937) specially provided by the G.P.O. for the purpose, and over a coaxial cable for the first stage of the journey from Alexandra Palace to the Museum telephone exchange and the last stage from Birmingham to Sutton Coldfield. A coaxial cable link is also being provided by the G.P.O. between London and Birmingham so that ultimately it will be possible to send the vision programme signals by alternative means.

Transmitter Hall

The central part of one wing of the building is taken up by the transmitter hall, where both the sound and vision transmitters are situated. The latter operates on a carrier frequency of 61.75 Mc/s, which corresponds to a wavelength of 4.86 metres. Its normal peak output is 35 kW, which is more than double the power of the London station. Asymmetric sideband transmission, in which one sideband is partially suppressed, is being used, in order to increase the number of transmission channels available within the limited band of frequencies allocated to television, thereby making room for further transmitters to serve other parts of the country.

The valves and components are housed in ten cubicles arranged in line to have an overall length of 38ft. On the left, viewed from the front, is the modulator, and on the right is the radio frequency amplifier. All of the larger valves are air-cooled except those in the output stage, which are cooled by pumping water through the valve jackets. During cold weather the heat carried away from these valves can be turned to good account and used to warm the transmitter hall.

Film scanning equipment. The panel controls waveform amplitude and picture waveform

High-voltage supplies for the vision transmitter are derived from hot-cathode mercury-vapour rectifiers. The phases of the 415 V a.c. supply to the transmitter are stabilized and phase-balanced by three separate moving-coil voltage regulators. In addition, the h.v. anode supplies, for which constancy of output is important, are provided with valve-operated stabilizers. Furthermore, the smoothing circuit associated with the anode supply to the modulated radio-frequency output stage has been designed to have a low resistive impedance which is constant over most of the vision modulation frequency range.

All the valve filaments are a.c. heated, except those of the valves in the modulated output stage, which are supplied with d.c. from a motor-generator. An electronic regulator keeps the output voltage to within 0.1 per cent of the nominal value and also limits the starting current when the transmitter is being powered.

The sound transmitter, which operates on a carrier frequency of 58.25 Mc/s corresponding to 5.15 metres, is amplitude modulated and has a power output of 12 kW. All the valves are air-cooled and the anode and bias supplies are obtained from rectifiers in the power-conversion plant. All valve filaments are a.c. heated

From the desk in the control room the engineer has a clear view of both of the transmitters

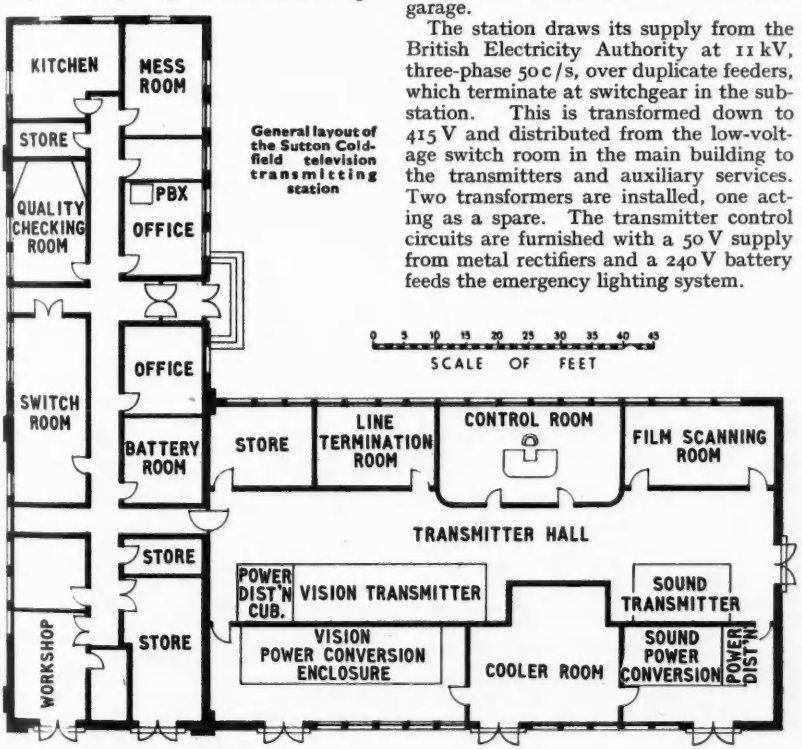
except that in the modulated output stage, which is fed with d.c. from a motor-generator. This has an electronic voltage regulator similar to that associated with the vision transmitter.

Both transmitters are operated from a single desk in the control room, which is so placed that the engineer has a clear view of the equipment in his charge. The supplies for the vision transmitter are controlled by two pairs of push-buttons, one pair being for the modulator and the other for the radio-frequency stages. Of each pair, one button controls the h.v. and bias supplies, and the other the valve cooling equipment and the filament supplies. By operating the push-buttons, power is applied to each stage of the transmitter in the correct sequence, with predetermined pauses between each step in the sequence. Facing the desk is a mimic diagram having some 200 lamps that light up in turn as the supplies to each stage are established.

In the centre of the desk is a waveform monitor, which can be switched to the output of each stage in the modulator and also to a pick-up probe in the output circuit of the modulated radio-frequency amplifier. There is also a high-grade picture monitor, on which can be displayed the picture at the modulator input and output and also the picture as radiated.

In the event of a breakdown in the radio or cable link from Alexandra Palace there is a room at Sutton Coldfield containing a film scanner and associated equipment, by means of which cinematograph films can be televised, thereby providing a standby source of programme material. The rest of the building is occupied by offices, a canteen and a quality checking room, while an auxiliary building provides accommodation for the electricity sub-station and a garage.

The station draws its supply from the British Electricity Authority at 11 kV, three-phase 50 c/s, over duplicate feeders, which terminate at switchgear in the sub-station. This is transformed down to 415 V and distributed from the low-voltage switch room in the main building to the transmitters and auxiliary services. Two transformers are installed, one acting as a spare. The transmitter control circuits are furnished with a 50 V supply from metal rectifiers and a 240 V battery feeds the emergency lighting system.



General layout of the Sutton Coldfield television transmitting station

Referring back to the aerial mast, this has an all-up weight of 140 tons and is supported by four sets of stays. From the base to the 610ft level it is triangular in cross-section, each side being 9ft across. There is a lift inside this section. Between 610ft and 710ft the mast is cylindrical, with slots cut in the surface to form a v.h.f. aerial for sound broadcasting should this system be installed at Sutton Coldfield in the future. Surmounting the cylindrical section is the topmast supporting the television aerials. These comprise two tiers of four vertical dipoles and radiate both sound and vision signals. In order to prevent icing each dipole incorporates an electric heater, the supply to which is controlled from the ground.

The range within which consistently good reception of the programmes broadcast by Sutton Coldfield can be expected depends upon many factors. Chief among these are the presence or absence of high ground between the transmitting station and the receiving point, the height of the receiving aerial and the amount of electrical interference in the vicinity of the receiver. As all these factors vary widely from place to place, no hard and fast figure can be given for the range, but in general terms it is expected to be about fifty miles.

The picture quality radiated is in no way impaired by being relayed from Alexandra Palace and viewers in the Midlands can count on entertainment equal in every respect to that enjoyed by Londoners.

The principal contractors for the new station include Electric and Musical Industries, Ltd., for the vision transmitter, control equipment, power plant, etc.; Metropolitan-Vickers Electrical Co., Ltd., vision radio-frequency equipment; Marconi's Wireless Telegraph Co., Ltd., sound transmitter and auxiliaries, aerial and feeder system; Brush Electrical Engineering Co., Ltd., main l.v. switchgear; Standard Telephones and Cables, Ltd., auxiliary l.v. switchgear, rectifiers, terminal coaxial cables, etc.

Opening Ceremony

The official opening of the new service by the Postmaster-General (Mr. Wilfred Paling) was timed for 8 p.m. on Saturday, but there was a few minutes' delay caused by a valve fault in the vision transmitter. Messages received later showed that there had been satisfactory reception from Sutton Coldfield as far as 120 miles away.

Speaking at a luncheon which preceded the opening, the chairman of the B.B.C. Governors (Lord Simon of Wythenshawe) outlined the Corporation's television plans. He said that their three-year plan should result in five major stations, giving television to 70 per cent of the population and improved studio accommodation would be in operation. Ten stations would be in service by the end of their five-year plan. Following the London and Midlands stations there would be major transmitters for Northern England, Central Scotland and Wales. Then there would be somewhat smaller stations at Newcastle, Southampton, Aberdeen, Belfast and Plymouth.

He could not promise separate regional programmes during the first five years but arrangements were being made for outside broadcasts in the various regions. An early development would be an afternoon programme for children and more frequent newsreels. Five large film studios were being equipped at Lime Grove (London) and they hoped that the seven-acre Shepherd's Bush building would be the finest television centre in the **world.**

E.I.B.A. Target

IT is pleasant to hear from Mr. H. Senior Fothergill, secretary of the Electrical Industries Benevolent Association (32, Old Burlington Street, London, W.1) that there has been an upward turn in the year's subscription curve. For the first ten months there was a short-fall of £3,000 from the amount aimed at but during November income exceeded the month's target, reducing the margin to £2,250. There should be a further narrowing of the gap in December.

Amounts of £50 and over included in the November income were: Belling & Co., Ltd., £104; Electrical Apparatus Co., Ltd., £100; Mullard Electronic Products, Ltd., £50; Cable Makers' Association, £200; J. Stone & Co., Ltd., £100; Marryat & Place, Ltd., £100; Gramophone Co., £126; Electric Lamp Manufacturers' Assn., £200; Edison Swan Electric Co., Ltd., £120; British Insulated Callender's Cables, Ltd., £500; Magnet Club, Witton (proceeds from dance), £188.

Personal and Social

NEWS OF MEN AND WOMEN OF THE INDUSTRY

THE Minister of Fuel and Power has appointed **Mr. H. Evans,** J.P., of Liverpool, to succeed the late Councillor Aled O. Roberts, J.P., as chairman of the Merseyside and North Wales Electricity Consultative Council. Mr. Evans has been a part-time member of the Merseyside and North Wales Electricity Board since January, 1948. He is well known in Liverpool and North Wales for his activities in connection with the National Union of Municipal and General Workers. He was a member of the Liverpool City Council, and served on the Electric Power and Lighting Committee.

Mr. W. K. G. Allen, M.I.Mar.E., A.M.I.N.A., joint managing director of W. H. Allen, Sons & Co., Ltd., and **Mr. A. H. Chilton,** M.I.Mech.E., M.I.E.E., M.I.Loco.E., director of J. Stone & Co., Ltd., have been elected to the Council of the British Engineers' Association

Mr. D. Collett has been appointed area manager for Manchester and the north of British Moulded Plastics, Ltd., and **Mr. W. J. Taylor** as area manager for the southern counties.

Mr. D. G. Cameron has recently been appointed as home sales supervisor to Bylock Electric, Ltd.

Mr. B. Graham, A.M.I.E.E., previously deputy to the late Mr. H. C. Price, has now succeeded him as manager of the Birmingham and district sales office of George Ellison, Ltd. Mr. Graham was educated at the Junior Technical College and the Royal Technical College, Salford, and served an apprenticeship with Switchgear & Cowans, Ltd., Old Trafford, where he later gained further training in the Sales and Contract Department. He joined George Ellison, Ltd., in 1930 and was transferred to their Birmingham sales office in 1933, becoming an outside technical sales engineer in 1935. He was appointed deputy manager in 1944. Mr. Graham is a member of the Birmingham Electric Club and the Leicester Electrical Society.

Mr. B. Graham

At the annual general meeting of the British Steel Founders' Association, **Mr. F. W. Rowe,** B.Sc., F.I.I.A., was elected chairman. Mr. Rowe is managing director of K. & L. Steelfounders & Engineers, Ltd. He was educated at Manchester Grammar School and Manchester University, and started his engineering career as a foundry apprentice with Metropolitan-Vickers. He has been associated with pioneer work for many improvements in methods and technique in British foundry practice, including the use of X-rays for inspecting steel castings. Since joining K. & L. Steelfounders & Engineers, Ltd., he has supervised the building of new research laboratories and the erection of a new electric steelmaking shop.

Mr. F. W. Rowe

Mr. W. C. Griffiths, Controller of London Telephones, has retired after 39 years' service. Mr. Griffiths was born in New Zealand and was educated at Canterbury and at London University. He joined the National Telephone Co. in 1910 and has been associated with many telephone developments.

Mr. N. C. Robertson, M.B.E., deputy managing director of E. K. Cole, Ltd., has returned from a visit to India and Pakistan, during which he inspected the progress made in the production of National-Ekco radio receivers in India.

Mr. S. Flax, B.Sc. Tech., A.M.I.E.E., manager of the Mining and Welding Departments of Siemens-Schuckert (Great Britain), Ltd., has been appointed a director of the company. Mr. Flax received his technical training at the College of Technology, Manchester University, where he gained the degree of B.Sc. Tech. in electrical engineering. After seven years with the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, he joined Siemens-

Schuckert (Great Britain), Ltd., in 1929. Mr. Flax is a member of the Association of Mining Electrical and Mechanical Engineers, and was president of the London Branch during the 1947/48 session.

We are glad to learn that **Mr. C. A. Turner,** managing director of "Diamond H" Switches, Ltd., who is in a London clinic, is making a good recovery from a throat operation and that he hopes to resume business duties early in the New Year.

Mr. W. F. Talbot has been appointed a director of the Kalgoorlie Electric Power & Lighting Corporation, Ltd.

Mr. C. H. Kirkland, who has retired from the position of accountant to the Leicester Sub-Area of the East Midlands Electricity Board, has been presented with a writing bureau. The presentation was made, on behalf of the staff, by Mr. D. H. Parry, the Sub-Area manager.

Mr. E. W. Sugden, B.Sc. (Tech), A.M.I.E.E., chief engineer and a director of Parmiter, Hope & Sugden, Ltd., has been elected chairman and appointed managing director of the company in succession to the late Mr. V. Hope.

The annual dinner and dance of the **Reliance Telephone Co., Ltd.** (a subsidiary of the General Electric Co., Ltd.), was held at Lord's Hotel, St. John's Wood, on 10th December. Mr. E. Silbermann, managing director, presided and was supported by Messrs. V. Amberg and W. T. Ashton, directors of the company. The toast of the company was proposed by Mr. H. J. McCusker, manager of the Glasgow branch, Mr. E. Silbermann responding. Later in the evening several members of the staff contributed light entertainment.

Confidence in the future was expressed by Mr. A. G. E. Briggs, managing director of the **Simplex Electric Co., Ltd.,** when he spoke at a ceremony held in the works canteen, Oldbury, Birmingham, on 12th December, at which gold wristlet watches were presented to seventy-four employees who had completed more than a quarter of a century with the firm. He believed that in spite of the difficulties, they were better equipped to face the future than ever before.

More than 350 employees with between twenty and forty years' service with **International Combustion, Ltd.,** sat down to dinner at the company's Derby Works on 10th December. To commemorate their service each had received a certificate and either a clock or a watch. Sir George Usher, managing director, sent greetings and best wishes from South Africa by means of a recorded message. The guest of honour was Viscount Hall, P.C., First Lord of the Admiralty, who, in proposing the toast "Old Campaigners," emphasized the fact that the number of long-service employees present—about 22 per cent of the company's total staff—was a happy reflection of the spirit of co-operation existing between management and work people. Mr. J. Mayer, special director of I.C.L., and Mr. J. Buttriss, convener of shop stewards of the Boilermakers' Union, replied. The toast of the company was proposed by Mr. J. C. Farrant, and Mr. G. Taylor, chairman of I.C.L., replied.

The **Atozed Social Club** (employees of Atozed (London), Ltd.,) held their annual dinner and dance at the Windsor Castle Hotel, Victoria, London, on 3rd December. The company numbered eighty-five, and in proposing the toast of the club, Mr. G. E. West outlined the past activities and recalled the friendly atmosphere which prevailed at all their functions. He thanked the management for their valued help in making the scheme so successful, and particularly mentioned Mr. J. A. Gould, managing director, for his personal efforts and interest. Mr. Gould, in responding, said that several important contracts had been obtained in various parts of the country and the prospects for 1950 were very encouraging. He thanked all employees for their services. Dancing and games followed the dinner.

A dinner was held at the George Hotel, Walsall, on 8th December, to mark the first long-service presentations to employees of **J. A. Crabtree & Co., Ltd.** Gold watches, suitably inscribed, were presented by Mrs. G. E. Crabtree to forty-two employees who had been with the company for twenty-five years or longer. Among the invited guests of the evening were a further eighty-eight employees who had been with the firm for twenty years or more. In proposing the toast of "Our Guests," Dr. H. Schofield (chairman) referred to the history of the company which commenced in 1919, and said that it was right that they should do honour to those who had been with them for more than two decades, for by working as a team they had played an important part in building the company's reputation. Other speakers were Messrs. E. Badham (director), J. A. Crabtree (works director), S. V. Morgan (the first employee to be engaged), and C. W. G. Summerton (senior representative).

The annual ball held in aid of the **Electrical Industries Benevolent Association** at Brighton on 27th October, proved a great success, and as a result £174 has been sent to the Association. The 1950 function will be held on 27th October.

The second annual reunion dinner of the **County Group Engineers' Society** was held

at the Chez Auguste Restaurant, Soho, on 16th December, at which 150 old members and colleagues were present. The chairman was Mr. C. P. Croft and the guests Sir Robert Renwick and Mr. W. J. H. Wood.

Obituary

Mr. H. Hooper.—On Tuesday last Mr. Henry Hooper, secretary of the Midlands Division of the British Electricity Authority, was taken to hospital for an emergency operation and died. Mr. Hooper was 63 years of age. He was educated at the Birmingham Municipal Technical College (of which he was an associate) and received his engineering training in the locomotive department, Midland Railway Co., and the Birmingham Electric Supply Department. He was with the latter until the 1914-18 war when, after service in the R.E. and R.A.F., he became manager of Veritys, Ltd. In 1928 he joined the Central Electricity Board as frequency-change engineer and held that position until vesting date. He acted as secretary of the C.E.B. Consultative Committee from 1930 to 1948.

Mr. Hooper had been hon. secretary of the South Midland Centre of the I.E.E. since 1915; he was chairman of the Centre in 1937-38. He was president of the Birmingham Electric Club in 1938-39.

Mr. E. R. Coote, one of the last remaining links with the original works of Laurence, Scott & Electromotors, Ltd., died on 11th December. Mr. Coote gained his technical knowledge at the School of Telegraphy and Electrical Engineering, Hanover Square, obtaining the certificate of that Institution in 1885. After some practical experience as a ship's electrician (in charge of the plant used for the navigation of the Suez Canal at night), he joined Laurence, Paris & Scott in 1888. There he worked on the design and testing of generators and motors, under the late Mr W. H. Scott. During his long service with the company (nearly fifty years) Mr. Coote saw and assisted in the introduction of carbon brushes, interpoles, enclosed machines, ball and roller bearings, etc., and he was associated with the design of some of the first motors for cranes, lifts, printing presses, and marine applications. Although he retired some considerable time ago he was still keenly interested in technical matters.

Mr. A. H. Avery.—The death occurred recently, at the age of seventy-five, of Mr. A. H. Avery, A.M.I.E.E., who, at the time of his retirement, in 1930, was technical director and adviser to the Electrical Department of George Kent, Ltd., Luton. Mr. Avery received his technical education at Croydon County Polytechnic and in 1896 joined the Crypto Manufacturing Co. as an improver. From 1897 to 1900 he was assistant electrician with the Lancs & Yorks Railway Co. at Horwich, and during the next nineteen years was director and general manager of his own works at Tunbridge Wells. He designed a number of fractional h.p. motors, rotary convertors and transformers. Mr. Avery produced a number of technical books including "Practical Armature Winding," Electric Motor Management," "Small A.C. Motors," "Electric Lighting" and "Dynamo and Electric Motor Building."

Mr. F. Ridout.—The General Electric Co., Ltd., announces the death on 15th December, after a short illness, of Mr. F. Ridout, manager of the G.E.C. Liverpool Branch. Mr. Ridout joined the company in the Accounts Department in London in 1902. After serving in the Accounts Departments at Newcastle, Hull, and Manchester, he was appointed branch accountant, Liverpool, in 1913. Mr. Ridout was transferred to Cardiff as branch accountant in 1922, and in 1930 returned to Liverpool as assistant branch manager. He was appointed manager, Liverpool Branch, in 1931 on the death of Mr. Fred Crawford.

Mr. Ridout had been local area secretary of the West Lancs., Merseyside and North Wales Area of the Electrical Industries Benevolent Association for a number of years, and was an active rotarian. The funeral took place at Landican Cemetery, Birkenhead, on December 19th.

Mr. T. F. Adamson, a member of the head office staff of the International Marine Radio Co., Ltd., Croydon, has died at the age of thirty-three years following a short illness. Mr. Adamson had previously served on the company's seagoing staff for four years, and was in the s.s. *Bradford City* when she was torpedoed in 1941.

Mr. H. M. Sayers, one of the veterans of the electrical industry, died at his home at Sheepscombe, Glos, on Tuesday last. He was eighty-nine.

Wills

Mr. J. Miller, M.B.E., M.I.E.E., for over twenty-five years manager of the Glasgow district office of British Thomson-Houston Co., who died on 10th September last, left personal estate in England and Scotland valued at £13,756.

Mr. J. Lamont, a director of Henley's Tyre and Rubber Co., Ltd., and W. T. Henley's Telegraph Works Co., Ltd., who died on 21st September last, left £44,092 gross (£41,049 net).

Mr. R. C. W. Joyce, A.M.I.E.E., commercial officer for the South Eastern Electricity Board's Mid-Sussex Sub-Area, left £1,851 gross (£1,490 net).

Views on the News

By REFLECTOR

HAVING had to replace four rod type fire elements broken variously by a chair being knocked over, a baby's clutching fingers and by children's somewhat boisterous games, I have come to the conclusion that element guards leave something to be desired. Very few makes of fire provide more than the most superficial protection. No child of average enterprise is thwarted in attempts to touch the elements, while any but the lightest blow is sufficient to buckle the guard and almost inevitably results in the breaking of the ceramic former of the element. It would not appear to be beyond the ingenuity of manufacturers to devise a guard, which without detriment to appearance and efficiency, would provide real protection both against burns and fire and also physical damage of the elements. Less substantial guards would of course be required if it were found possible to produce more robust element formers.

★ ★ ★

It was complained at a recent meeting of a Welsh rural district council that the British Electricity Authority had not sent Welsh-speaking officials to explain a scheme for the electrification of rural areas. No doubt the Scots would also put in a claim to be addressed in Gaelic and there is a case for the use of the appropriate dialect in parts of England. Thus the B.E.A. should think about setting up a linguistic department to ensure good public relations in all areas.

★ ★ ★

Much is made of "suggestion schemes" operated by industrial concerns for there is no doubt that they act as an incentive to workers' interest in the day-to-day operation of their concerns and, moreover, produce valuable hints for managements. It is interesting to be reminded that one of the oldest suggestion schemes is that operated by the General Post Office. This has now been running for 43 years in the course of which £42,000 has been paid to employees. Over 128,000 suggestions have been put forward. Not all of them have been adopted, but it is the practice to award small amounts to encourage "suggesters," even if their proposals have not proved acceptable. The highest recent award was one of £30 to an engineering draughtsman for a suggestion concerning the use of stencils for repetitive work on diagrams and drawings.

★ ★ ★

A precedent for our Electricity Boards to follow is recorded in the October *Edison Electric Bulletin* (United States). It is an account of the celebrations organized on the occasion of the connection of the 100,000th farm consumer by the Consumers' Power Co., Michigan. The ceremonies included a barbecue (a sort of ox-roasted-whole affair, rather difficult to arrange in this country), a speech by the Governor of Michigan, a full-scale farm equipment show by national electrical manufacturers, continuous cooking and home freezing schools for farmers' wives and an all-day band concert. Michigan claims that 99 per cent of its farms are now "electrified."

★ ★ ★

Recent correspondence has suggested that all is not well with sales engineers. I have discovered one reason for this; they are suffering from lack of sound sleep. An advertisement for a well-known milk beverage tells of a salesman who because of this lost a £100,000 South American contract. He was evidently in the electrical line, for after taking a mouthful or two of the well-known beverage he secured a "tricky dynamo contract."

★ ★ ★

The caption to one of the photographs relating to the power station strike read:—

> "This Naval rating, who maintained power at Brimsdown (Enfield) power station last night, carries his bed with him, at the station this morning."

It looks as though this sturdy and versatile sailor managed to relax in the course of his Herculean labours.

Grid Performance

Statistical Survey of Lighting Fault Rates

MAIN conclusions that have been formed from an analysis of the 1,157 faults attributed to lightning which have occurred during the fourteen years ended in 1947 on the 5,900 miles of overhead power lines of the British grid system were set out in the paper which Dr. J. S. Forrest read before the Supply Section of the I.E.E. last week.

Thunderstorm frequency was 13 days a year, while annual fault incidence varied greatly, from the minimum of 40 faults in 1947 to the maximum of 119 in 1936, a ratio of one to three. The percentage which "interrupted supply" did not vary much, the average amounting to 46 per cent of the total, but in many cases this did not interfere with consumers as their load was carried by local plant. During the 14 years 17.5 per cent of the lines were free from faults. The commonest value was one fault in 14 years (on 24 per cent of the lines), while an average of one fault per year was experienced on only 0.5 per cent of the lines. Thus the mean annual rate was one fault per 100 miles of 132 kV line, 20 miles being the average route length, increasing to 3.8/100 on the 33 kV network. Both circuits of 132 kV double lines were involved in one out of four faults, or one in two cases on 33 kV lines. The proportion of single-phase flashovers was 80 per cent at 132 kV, decreasing to 70 per cent at 66 kV and to 60 per cent at 33 kV. Flashover tended to be associated with towers having high footing resistance, but the effect was small and there was no justification for special earthing electrodes. Footing resistance was less than 10 ohms at 80 per cent of towers on most lines.

Flashover damage was slight and in nine cases out of ten lines could be restored to service immediately after a fault. There was therefore considerable scope for the introduction of high-speed automatic reclosing switchgear, particularly for new lines, the performance of which could probably be improved at a lower overall cost by omitting the earth wire, except at line terminals.

Lightning caused 40 per cent of all faults on overhead lines; the frequency was highest in July, between 16.00 and 17.00 G.M.T. Lightning faults in substation apparatus amounted to only 12 per cent of the total lightning faults. Transformer trip-outs were 10 per year, but two-thirds of them were due to external flashover of protective gaps or bushings. There had been only two failures of transformer windings insulation per year, corresponding to 0.3 failure per 100 transformers a year. This considerable reduction was attributed to the provision of protective rod gaps (co-ordinating) on all transformers. Expulsion tubes within porcelain weather shields had been successfully used for the protection of 33 kV transformer windings.

Petersen coil earthing on 360 miles of the 33 kV system had suppressed 50 per cent of the lightning faults previously experienced. The general use of surge divertors on the grid system could not be justified. A few were being used experimentally. About 77 per cent of transformers on the 33 kV network were connected by cables to the overhead lines. Their failure rate was lower than that of directly connected transformers, but it was not suggested that cables should be provided solely for protection.

DISCUSSION

Mr. R. Davis (N.P.L.) opened the discussion by describing some calculations which he had made, before the paper became available, from which he estimated that on 132 kV systems, assuming an average earth resistance of 10 ohms, there should be about 0.5 fault per 100 miles in a year; on 33 kV lines it would be about 3.8.

Mr. P. J. Ryle (Merz & McLellan) pointed out that while the isoceraunic level was 13 for this country and 30 for South Africa, a ratio of 2.3/1, the ratio of fault rates for the two countries was more nearly 10/1. The important figure was not the isoceraunic level but the number of lightning strokes which reached the ground per square mile.

For the grid as a whole, June to August was the worst part of the year, but this did not necessarily hold for individual

smaller areas. Expectations were often wildly upset by severe local storms; in 1943 44 per cent of the whole year's grid faults occurred on two separate days in two quite restricted areas, while in 1944 29 per cent of the whole year's faults occurred within 48 hours in a few hundred square miles.

Valuable Records

Mr. D. P. Sayers (B.E.A.) said that the value of taking records over 14 years and 6,000 miles of line was that there was now available the experience of some 80,000 circuit-mile-years, a record probably unique in the world. It was accompanied by a careful analysis of the results, thus helping to eliminate guesswork. In the future, economic conditions might necessitate the use of double-circuit lines of very heavy capacity, making it necessary to assess the risk of outage against the only two unpredictable hazards, lightning and aircraft. An American paper had suggested that by using wood pole lines with unbonded steelwork the impulse strength could be increased to about 2,000 kV instead of the 700 kV on steel tower lines.

Mr. S. Morris Bower (Thunderstorm Census Organization) referred to the fact that the diurnal variation of lightning faults showed a maximum at about 4 p.m., which was some two hours later than the maximum for storms in the Thunderstorm Census.

Dr. J. McCombe (Yorkshire Electricity Board) said he had made an analysis of the faults in his system over the past 20 years. On the 66 kV system the faults due to lightning per 100 miles of line a year being 4.5. This was higher than the author's figure, but his lines were on steel towers instead of wood poles. For the 33 kV system the figure was 100 miles of line a year and on the 11 kV system, over a period of 12 years, the fault rate was 7.8.

Mr. D. F. Oakeshott (B.E.A. Research Laboratories) mentioned that the magnetic links installed on one of the towers at the Thames crossing showed that during last July there was a heavy stroke to the tower of about 24,000 A negative, followed by about 3,000 A positive. There was no sign of damage or faults on the tower.

Dr. R. Willheim said that the effects of the Petersen coils on the Eire system and the earth wire on the British grid system were roughly equivalent, although they acted differently, and suggested that arc suppression coils could well be supplemented by earth wires, and vice versa.

Mr. R. H. Golde (E.R.A.) said an attempt had been made to show from American results that the number of direct strokes to overhead transmission lines was proportional to the isoceraunic level, and there was now evidence that the number of faults on overhead lines was also proportional to the isoceraunic level. On lines of 33 kV and above all lightning faults were due to direct strokes, but below 33 kV they might be due to induced circuits.

Mr. B. Donkin (Kennedy & Donkin) said that the fault rate for single-circuit 132 kV lines worked out at 0.8 per 100 miles a year, whereas for a double-circuit the figure was 1.21. It might not be fair to deduce, however, that the fault rate per single circuit mile of double-circuit line would come to about half that figure, because 25 per cent of the faults on double-circuit 132 kV lines affected both circuits.

Dr. F. Stritzl questioned the author's statement that the widespread installation of surge diverters could not be justified on economic or technical grounds, especially with the great price reduction which had taken place over the last twenty years.

Mr. A. Morris Thomas (E.R.A.) said that the small number of serious failures of transformers had led to the conclusion that the installation of surge diverters was not justified, but it might be the case that transformer insulation was at too high a standard, and if this were lowered the saving in cost would more than offset the cost of the diverters.

Results from Three Systems

Mr. E. T. Norris (Ferranti) said that the British system, employing an earth wire and rod gap as the principal means of protection, and the Irish system, with no earth wire or rod gaps, but using Petersen coils, and the New Zealand system, using neither Petersen coils nor earth wires or rod gaps, but employing surge diverters, all had about the same record of faults. This was extraordinary, and any statistician would say that this meant that the most probable value for all three forms of protection was zero.

Mr. S. Lalander (Swedish State Power Board) said that the fault intensity on Swedish lines was about two or three times as high as on British ones, though in both cases the fault rate decreased as the voltage increased. The difference might be due to the fact that in Sweden an earth wire was not used on 130 kV lines except near a station and the earth resistance was much higher.

In reply, the author said he did not agree with Mr. Golde that the number of faults should be proportional to the isoceraunic level; the number of faults measured the real severity of the storms, which the isoceraunic level did not. There was no scope for the overall use of surge diverters at high voltages unless in that way a lower level of insulation could be used and thus a more economic system obtained without any reduction in reliability.

Load Flow Calculations

An Original Approach by Network Simplification

By J. B. McPHERSON,* A.M.I.E.E.

WHEN designing electricity supply networks it is necessary to calculate the load flow in each branch of the system under various conditions of loading and circuit outage.

Unless the designer has access to a load flow calculating table, the arithmetic involved can become very cumbersome when tackled by the usual methods and an attempt has been made in this article to develop a new technique to solve these problems.

In many cases the impedance angle of the branches and the power factor of the loads are each sufficiently similar throughout the network to permit the phase angles to be ignored and the problem solved by impedance or "d.c." methods.

The number of loads on a network can generally be reduced by grouping the individual loads on one branch and assuming them to be concentrated at one point. Fig. 1(a) represents a distributor AB with loads P and Q connected thereon. The impedances measured from A are x and z respectively.

Taking moments about A we have $xP + zQ = y(P + Q)$.

From this the impedance y from A to the combined load $(P + Q)$ can be calculated. The number of loads can thus be reduced to one on each branch of the network. It is more desirable in network simplification, however, to have the loads concentrated at junction points by transferring the loads to the extremities of the branches as shown in Fig. 1(b).

Taking moments about A we have $Px = Q(x + y)$. Therefore $Q = P\frac{x}{x + y}$.

Takin moments about B we have $Py = R(x + Y)$ and $R = P\frac{y}{x + y}$.

To be correct, the transfer loads Q and R must be equal to the original load P:—

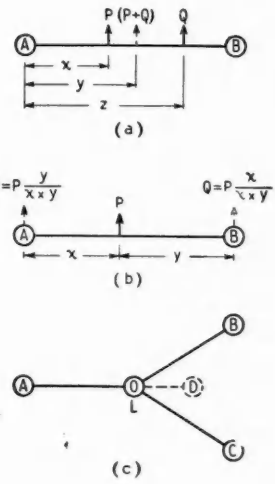
Thus $Q + R = P\frac{x}{x + y} + P\frac{y}{x + y}$

Therefore $Q + R = \frac{P}{x + y}(x + y)$ and $Q + R = P$.

In so far as the external circuit is concerned the loading is identical with the original condition, since the distributor when viewed from either end will have the same total load as before and produce the same effective IZ drop.

When all the loads have been transferred to junction points by the method described, a certain amount of network simplification will be possible by applying reduction formulae usually associated

Fig. 1.



* South East Scotland Electricity Board.

with short circuit calculations. This will release other loads for transfer and another reduction can be made, until by successive load transfers and network reduction the problem is reduced to a single circuit. By what amounts to reversing the above procedure, the load flows can be inserted step by step until the original network has been reconstituted.

For example Fig. 2(a) represents a network having impedances as shown and loads connected at B, C, D, E. It is required to calculate the load flows in the network when supplied from point A. In the first place, load C can be eliminated by transferring it to B and D by the method described above.

Proportion to be transferred to $B = 5.2 \dfrac{2.7}{2.7 + 3.8} = 2.16$. Proportion to be transferred to $D = 5.2 \dfrac{3.8}{2.7 + 3.8} = 3.04$. Check: $3.04 + 2.16 = 5.2$.

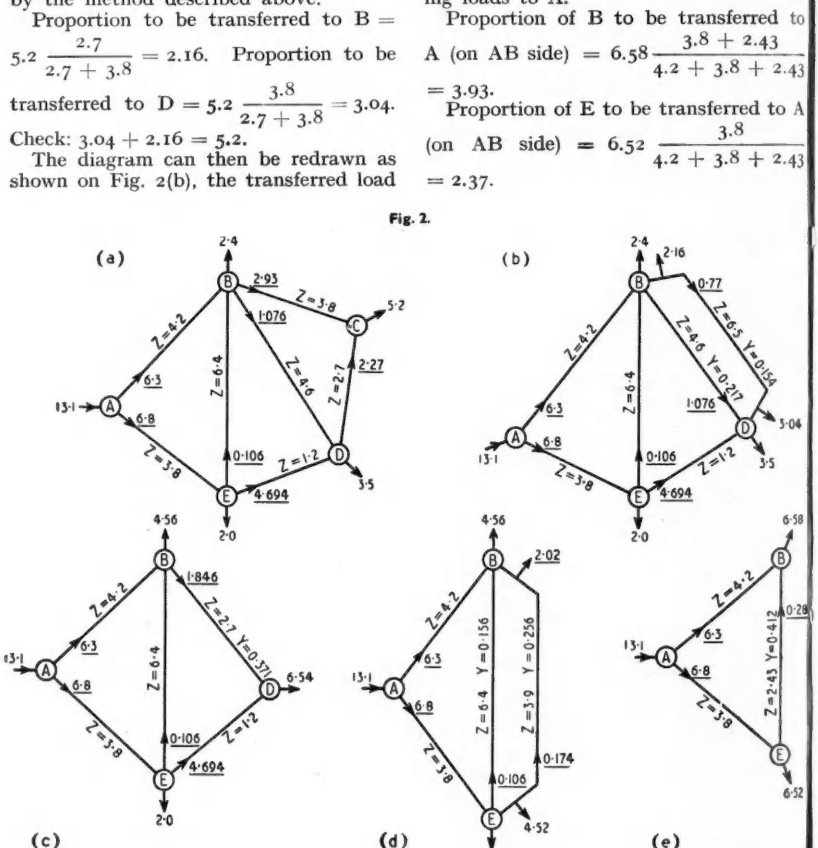
The diagram can then be redrawn as shown on Fig. 2(b), the transferred load on BD being indicated infinitely near to B and D, but still on the branch. The network can now be simplified by combining the parallel branches between B and D as shown on Fig. 2(c), at the same time adding the transferred load to the true loads at these points. The new load at D can now be transferred to B and E, resulting in Fig. 2(d) which, by the same reasoning as before, becomes Fig. 2(e).

We are now left with a simple ring main with two loads thereon which could easily be solved by Kirchhoff's laws. But, to demonstrate the method which has been adopted up to this point, carry it a step further and transfer the remaining loads to A.

Proportion of B to be transferred to A (on AB side) $= 6.58 \dfrac{3.8 + 2.43}{4.2 + 3.8 + 2.43} = 3.93$.

Proportion of E to be transferred to A (on AB side) $= 6.52 \dfrac{3.8}{4.2 + 3.8 + 2.43} = 2.37$.

Fig. 2.



Total load transferred to A (on AB side) = 3.93 + 2.37 = 6.3.

Proportion of B to be transferred to A (on AE side) = $6.58 \frac{4.2}{4.2 + 3.8 + 2.43}$ = 2.65.

Proportion of E to be transferred to A (on AE side) = $6.52 \frac{3.8 + 2.43}{4.2 + 3.8 + 2.43}$ = 4.15.

Total load transferred to A on AE side = 2.65 + 4.15 = 6.8.

Thus the ring main Fig. 2(e) will have a load of 6.3 flowing in branch AB and 6.8 in branch AE. The flow in EB will be 6.8 − 6.52 = 0.28 or 6.3 − 6.58 = −0.28, the minus sign indicating that the flow in EB is towards B. Returning now to Fig. 2(d) the flow from E to B will divide in proportion to the admittances of the parallel paths.

Flow in left hand path = $0.28 \frac{0.156}{0.156 + 0.256}$ = 0.106.

Flow in right hand path = $0.28 \frac{0.256}{0.156 + 0.256}$ = 0.174. Check: 0.106 + 0.174 = 0.28.

These flows can now be inserted in Fig. 2(d) so in Fig. 2(c) the flow in ED will be 0.174 plus the transferred load 4.52, making a total of 4.69. Similarly the flow BD = − 0.174 + 2.02 = 1.846. Check: 1.846 + 4.694 = 6.54 = load D.

The flow in BD can then be divided between the parallel paths in Fig. 2(c) as before and in the next step load C can be replaced and the load flows inserted in Fig. 2(a) to complete the problem. A final check can now be made from the fact that the sum of the IZ drops in mesh ABCDEA is zero. Check: 6.3 × 4.2 + 2.93 × 3.8 − 2.27 × 2.7 − 4.694 × 1.2 − 6.8 × 3.8 = 0.

In the foregoing example the arithmetic has been set out in some detail, but in practice most of this can be done mentally; in fact, all that need be set down is what is shown on the Fig. 2 diagram. The working can be cross checked at every stage of the calculations, thereby avoiding one of the chief disadvantages of solution by Kirchhoff's laws, namely, that although it is easy to check the final answer, it is often very difficult to locate and rectify the mistake. Furthermore the entire

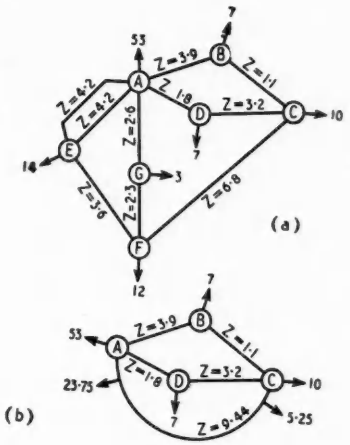


Fig. 3

calculation need not be repeated for each change of load (or system outage) condition, as much of the working is applicable to the new conditions.

When reinforcement is under consideration in one locality the remainder of the network can often be replaced by an equivalent circuit. In the network represented by Fig. 3(a) consider that only section ABCD requires reinforcement.

Various possibilities present themselves; for example, an additional circuit can be provided direct from A to C, or it may be that duplicating AD would suffice, and so on. In each case the remainder of the network would influence the load flows. It is desirable, therefore, to reduce this to a simple circuit with a load at each end as shown in Fig. 3(b). The problem is now much simpler, since this equivalent circuit remains constant no matter what is done to reinforce the section under review.

With some problems it will be necessary to resort to star-delta transformations to facilitate the reduction of the network. Before this can be done the load at the intersection of the star must be transferred to the extremities. In Fig. 1 (C), AO, BO and CO are connected at O to form a star with a load L at the centre. If OD is drawn to represent OB and OC in parallel, then the load L may be

transferred to A and D by the procedure already explained. Thus the amount of load to be concentrated at A is ascertained. The proportion to be assigned to B and C can be found by performing a

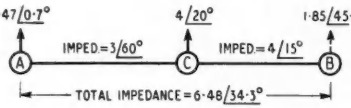


Fig. 4.

similar calculation and, if the arithmetic has been done correctly, the three loads should sum to the original load.

Where there are several generating stations connected to a network the most convenient one should be considered as the source and all others treated as negative loads. It should be realized, however, that a load point would serve equally well as a source, provided that the load is considered to be a negative generator. Indeed, in the example set forth in Fig. 2 the point B could with advantage have been taken as the source in preference to A. The diagram would then have been set down as having a load of minus 13.1 at A and an infeed of minus 2.4 at B.

When it is necessary to take phase angles into consideration the method of load transference still applies, although the calculations then become somewhat tedious. The principles involved are best demonstrated by a numerical example. Fig. 4 represents a distributor AB with a load at C. The phase angles of the load and distributor impedances are as shown. It is required to transfer the load to A and B so that conditions are unaltered in the external circuit.

Total impedance of distributor ACB:

$$AC = 3\angle 60^\circ = 1.5 + j2.6$$

$$CB = 4\angle 15^\circ = 3.86 + j1.04.$$

$$ACB = \underline{\qquad\qquad} = 5.36 + j3.64 = 6.48\angle 34.3^\circ$$

Proportion of load to be transferred to

$$A = \frac{4\angle 20^\circ \times 4\angle 15^\circ}{6.48\angle 34.3^\circ} = 2.47\angle 0.7^\circ.$$

Proportion of load to be transferred to

$$B = \frac{4\angle 20^\circ \times 3\angle 60^\circ}{6.48\angle 34.3^\circ} = 1.85\angle 45.7^\circ.$$

For these transfers to be correct, they should sum to the original load. Thus:

$$2.47\angle 0.7^\circ = 2.47 + j0.03$$

$$1.85\angle 45.7^\circ = 1.29 + j1.32$$

$$3.76 + j1.35 = 4.0\angle 20^\circ.$$

Problems can be solved completely in this manner if desired, but in many cases a considerable amount of work can be avoided by reducing the problem as far as possible by the "d.c." method, leaving only those sections wherein phase angles differ widely to be dealt with by symbolic algebra.

Progress in India

ACCORDING to the Central Electricity Commission, India, the production in 1948 of 4,575 million kWh represented an increase of 12.3 per cent over the preceding year, but total generating capacity at 1.4 million kW showed only a 3 per cent rise compared with 1947. Principal consumers of electricity in the Indian Union were industry (about 66 per cent of the total), domestic users (11 per cent), traction (7.9 per cent), commercial lighting, heating and cooking (6.3 per cent), public waterworks (4.7 per cent) and irrigation (3.3 per cent). In addition to production of electricity by public plants, industrial undertakings also generated about 1,150 million kWh for their own use. This was supplemented by 1,324 million kWh purchased from public electricity supply undertakings. Among major manufactures, cotton textiles consumed 1,078 million kWh and iron and steel, jute and cement together, 970 million kWh.

In 1948 the Indian Union had 363 separate generating stations—265 driven by oil, 65 by steam, and 33 by water-power. The steam stations accounted for 44.7 per cent of total power production and hydro-electric plants 51.9 per cent. Just over 63 per cent of the power generated was contributed by company-owned plants, 36 per cent by Government-owned plants, and less than one per cent by municipal undertakings. Of the total energy sold to ultimate consumers 91.2 per cent was supplied by a.c.

The per capita consumption showed great geographical variations. Delhi led with 95 kWh, followed by Bombay (49 kWh), Mysore (38 kWh), West Bengal (37 kWh), Travancore (18 kWh) and Madras (8 kWh). Assam and Orissa accounted for less than one kWh per capita. The proportion of electricity used for irrigation was highest in the United Provinces (15 per cent) and Madras (11 per cent).

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Paint for Aluminium

A PROCESS which overcomes the problems of painting aluminium effectively has been developed by DRYNAMELS, LTD., Shaftmoor Lane, Hall Green, Birmingham, 28, in association with TI Aluminium, Ltd. The process introduces a primer containing acid ingredients, resins and a corrosion-resisting pigment. It etches the metal surface, thus establishing a close adhesion and providing a corrosion-proof coating.

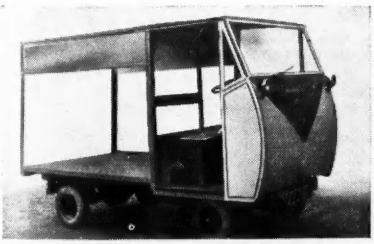
The primer can be applied by brush, spray or roller coating. Dry in fifteen minutes, it eliminates the need of pre-treatment equipment and is particularly useful for large aluminium structures unsuitable for other pre-treatment processes. It also can be applied to a wide range of other metals and alloys.

Battery Vehicle

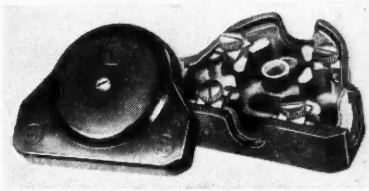
A newly designed 10 cwt battery electric vehicle is now being made by MIDLAND VEHICLES, LTD., Upper Grove Street, Leamington Spa, either as a closed or open van. The battery voltage is comparatively high (60 V) so it is of low capacity (75 Ah), which makes possible the use of a low output and less expensive charger and reduces the current in the electrical system, discharge on the level with full load being about 30 A.

The controller has three speeds with delayed-action operation and no break in circuit between studs. This is a useful feature, for although releasing the control pedal causes instantaneous cut-off, the starting resistance comes into circuit to limit the current which is finally broken.

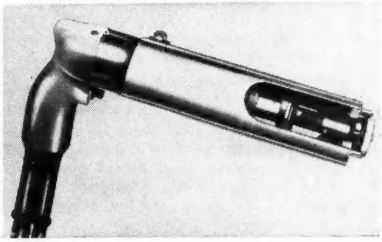
The motor is of generous size, being 3.75 h.p. at the one-hour rating. The "Midland" insulated drive is retained so that the motor is mounted in rubber and drives through a "Layrub" propeller shaft.



10 cwt Midland battery vehicle with 3.5 h.p. motor



Barclay-Stuart moulded plastic junction box



Cyc-Arc self-adjusting stud welding hand tool

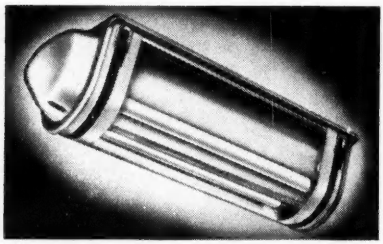
Wiring Junction Box

An inexpensive and robustly constructed junction box for domestic wiring systems is being marketed in the U.K. by BARCLAY-STUART (PLASTICS), LTD., Spencer House, South Place, London, E.C.2, after having been sold in Scandinavian countries for some time. The base, which contains four terminals and a threaded brass inset for fixing the lid, is of vitreous enamelled porcelain, while the lid itself is of moulded material.

Stud Welding Hand Tool

Weighing only about 5½ lb and being well balanced, a stud welding hand tool made by CYC-ARC, LTD., Stelmar House, 27-29, New North Road, London, N.1, provides self-adjusting compensation for minor variations in stud lengths or plate surface unevenness.

All moving parts are contained, together with the operating solenoid, within a



Metrovick "Borough" street lighting lantern

robustly constructed steel body, to which is fitted a pistol-grip handle with a press-button switch.

A Duralumin tube sliding over the steel body is adjustable to accommodate studs of various lengths up to 4½ in. and can also carry a spring-loaded ferrule holder when required. Alternatively a tripod attachment can be substituted to meet special requirements.

When used with the Cyc-Arc E1 electronic controller studs and attachments ranging in size from ⅛ in. to ⅞ in. diameter can be welded at a rate limited only by the speed at which an operator loads the tool and manipulates the work pieces.

Street Lantern

The "Borough" lantern introduced by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, 17, for lighting Group "B" roads, accommodates two 2 ft. 40 W type MCF/U tubular lamps, and all auxiliary gear. The lantern framework consists of two cast silicon aluminium endplates held rigidly in line by a mild steel canopy and a ½ in diameter steel tie rod. All steel parts have been treated to prevent corrosion.

The endplate at the "road" end of the lantern has a blown "Perspex" wiring cover attached, which gives access to the mains terminal block. The optical system, consisting of two high grade polished aluminium reflectors, is protected by a clear "Perspex" cover and is held in position by four toggle clips, which enables the cover to be easily removed for maintenance purposes.

Photometric Cell

Progress in the development of photoemissive photocells is indicated by the photometric cell type 57CV introduced by MULLARD ELECTRONIC PRODUCTS, LTD., Century House, Shaftesbury Avenue, London, W.C.2. This cell, which is of the vacuum type, has a specially prepared cathode of caesium on oxidized-silver and is intended for use in circuits designed for making accurate photometric measurements in the red and infra-red region of the spectrum. The sensitivity, when measured with a lamp of colour temperature 2,700 deg K at 0.1 lumen with total area of one side of the cathode illuminated, is 25 μA per lumen.

The 57CV is fitted with a standard British 4-pin base and requires an anode supply voltage of 100V.

Coffee Percolator

A coffee percolator introduced by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2, has been designed on "classical" lines. Its heavy gauge copper body is chromium plated, while the interior is tinned. The comfortable handle is of heat-resisting black moulded material and the spout is designed so as not to drip. The mica-wound element has a loading of 400 W; a safety plug prevents damage should the percolator be switched on empty or allowed to boil dry. The capacity is eight cups and the retail price is 90s.

Portable Fire

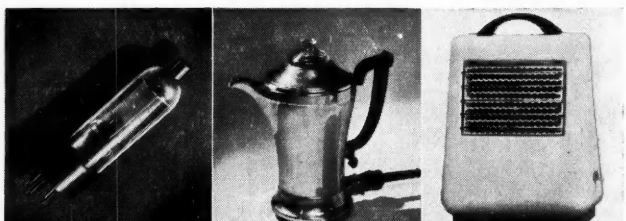
Although the "Ashby" fire has been designed by the ARORA COMPANY, Rosebery Street, Loughborough, primarily as a portable radiator, it has a flat back to enable it to stand in front of a fireplace opening. Loaded at 2 kW, it is fitted with Arora "C"

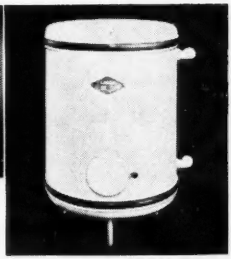
(1) (2) (3)

(1) **Mullard photometric photocell**

(2) **Hotpoint 8-cup coffee percolator**

(3) **Arora "Ashby" portable fire**





G.E.C. cold cathode lighting fitting

(Left) R.E.A.L. plinth light

(Right) "Sadia" water heater

bars using heavy duty tape windings which are not only reliable but give a very pleasing effect and quick heating. Measuring 18¾in by 14in wide by 5¼in deep, the modern-style body is of sheet steel, stoved enamelled in cream, the handle being a walnut-coloured moulding. It is fitted with a weighted base for safety. The price is £4 19s 6d, plus purchase tax in the United Kingdom. The company's convector is also being produced again.

Plinth Light

The beauties of floral decorations, statuettes, etc., are greatly enhanced by the use of the new R.E.A.L. plinth light made by ROWLANDS ELECTRICAL ACCESSORIES, LTD., Hockley Hill, Birmingham, 18. The unit comprises a pressed-steel base with a frosted glass disc at the top through which shines the light from a 15 W or 25 W lamp. The standard finish is pastel cream enamel, but pastel rose and pastel blue are also available. Complete with shockproof porcelain b.c. lampholder and 3 yd of transparent plastic-covered, flexible cable, the plinth is priced at 30s, including United Kingdom purchase tax.

Cold Cathode Fittings

To meet the demand for cold cathode lighting fittings in the commercial world where harmony with existing architecture is desirable, the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has introduced a series of units having transformer and electrode boxes of circular design. They are made as three- or two-tube fittings, each being available for different colour and current combinations. In their standard form, with cream finish, the fittings are free of purchase tax. Decorative finish can be applied to the circular end pans if required, in which case purchase tax is payable by buyers in the United Kingdom.

Under-counter Water Heater

Designed for installation beneath the counter in public houses, restaurants, etc., the type U.T.C. "Sadia" water heater has a capacity of 3 gall, overall dimensions being 17⅝in high by 13⅜in diameter. Wall fixing brackets are fitted and provision is also made for attaching three short feet if floor mounting is preferred. The standard feet add 3in to the height. The single 1,500 W thermostatically controlled embedded rod element is mounted on a plate which is removable from the front of the water heater. The inlet and outlet connections are at the side. The apparatus, which is suitable for a.c. only, can be operated either as a free outlet or a pressure type water heater. It is available from AIDAS ELECTRIC, LTD., Sadia Works, Rowdell Road, Northolt, Mdx., for 14 gns, or with feet for floor mounting for £15 (plus purchase tax in Great Britain in both cases).

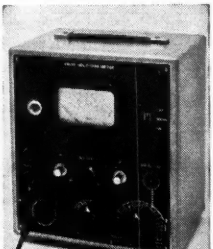
Terminal Panels

A comprehensive range of terminal panels to meet the requirements of the radio industry has been introduced by the PLESSEY CO., LTD., Ilford, Essex. Manufactured of $\frac{1}{16}$in thick synthetic resin bonded paper, they may be obtained either plain or engraved with all normal markings—aerial-earth; pick-up; deaf aid phones; external loudspeaker, etc., Tags and sockets are available in alternative finishes.

Ultrasonic Soldering Iron

The soldering of aluminium and other light metals and alloys is facilitated by an ultrasonic soldering iron, type E7587, announced by MULLARD ELECTRONIC PRODUCTS, LTD., Century House, Shaftesbury Avenue, London, W.C.2.

It consists essentially of a removable copper soldering bit and a magneto-striction transducer. The soldering bit, which is heated by means of a conventional resistance winding, is secured to a brass block held in contact with the nickel core of the transducer. The ultrasonic power necessary to drive the transducer is supplied by an electronic amplifier comprising the power supply unit.



Mullard volt-ohm a.c. and d.c. meter

In this soldering iron the problem of temporarily destroying the refractory oxide film, which forms on most light metal and alloys, is solved by ultrasonic stimulation. No flux is required and standard soft solders may be employed. To avoid electrolytic action, however, it is advisable to use a solder with a tin-zinc base instead of tin-lead alloy.

The soldering bit is allowed to rise to the usual operating temperature, the transducer then being energized, and the bit tinned by applying soft solder. After this, soldering is carried out in the normal way, care being taken to maintain a good liquid contact between the bit and the work, thereby ensuring the maximum acoustic efficiency and enabling positive and uniform joints to be made. The ultrasonic frequency chosen to operate the bit is well above the normal audible range, so that no discomfort is experienced by the operator.

Volt-ohm Meter

An instrument which has recently been made available by MULLARD ELECTRONIC PRODUCTS, LTD., Century House, Shaftesbury Avenue, London, W.C.2, is designed to measure a wide range of a.c. and d.c. voltages and resistances. The input resistance and accuracy are extremely high and an important feature is the stable zero setting, which does not alter from range to range.

The ranges are 0-100 V d.c. on four ranges, 0-10 kV a.c. at up to 10 kc/s on four ranges, and 0-100 V a.c. at up to 30 Mc/s on four ranges. There are six resistance ranges covering from 0-2 MΩ. The dimensions of the instrument are 12in high by 12in wide by 8in deep and the weight is 20 lb.

Time Delay Switch

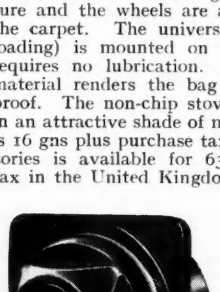
The "Quip" single-pole push-button vacuum operated time delay switch is an addition to the range of products made by the POWER EQUIPMENT CO., LTD., Kingsbury Works, The Hyde, Hendon, London, N.W.9. It is fitted with an adjustable time setting device permitting any delay period from two seconds to one hour and can be supplied for use on circuits of up to 15A, 240V a.c., 10A 440V a.c. and 2A 240V d.c. The switch is of moulded construction in various colours and is suitable for surface or semi-recessed mounting when used with a separate escutcheon. An industrial metalclad model is also available.

Lever-operated Toaster

The "Speedy" electric toaster is switched on when a lever is depressed. Releasing the lever "pops-up" the toast and switches off the electricity. The toaster is manufactured in steel, with a highly polished chromium-plated finish, and is supplied complete with two yards of three-core way flex. The loading is 650 W. The apparatus, sold at 39s 6d, is made by KEITH ELECTRICAL INDUSTRIES, LTD., Thorburn Street, Manchester 13.

Vacuum Cleaner

The special design of the rotating brush of a new vacuum cleaner brought out by MORPHY-RICHARDS, LTD., St. Mary Cray, Kent, ensures gentle but effective removal of grit and hair, at the same time reducing carpet wear and easing work. A curved handle facilitates cleaning under low furniture and the wheels are adjustable to suit the carpet. The universal motor (300 W loading) is mounted on ball-bearings and requires no lubrication. Specially woven material renders the bag completely dustproof. The non-chip stove enamel finish is in an attractive shade of maroon. The price is 16 gns plus purchase tax. A set of accessories is available for 63s, plus purchase tax in the United Kingdom.



"Quip" single-pole vacuum delay switch

Morphy-Richards vacuum cleaner

PARLIAMENTARY NEWS

By Our Special Reporter

IN the House of Commons last week Col. James Hutchison asked the Minister of Supply what steps he would take to promote the manufacture of television transmission and receiving sets in this country and so promote a flourishing export trade.

Mr. John Freeman said that the Minister understood the importance to our economy of promoting the manufacture of television transmitters and receiving sets in this country, and after consultation with the industry, had informed them that he was willing to consider any way in which the Government could properly assist manufacturers in their efforts to promote production and export in the television field.

Mr. Erroll asked the Postmaster-General if he was now in a position to announce whether the television transmitter programme would escape economy cuts.

Mr. Hobson, the Assistant Postmaster General, said the extension to Holme Moss was not affected by the cuts in capital expenditure made so far, but he could not give any assurance as regarded expenditure in later years on the remainder of the plan.

Replying to Col. J. Hutchison, Mr. Hobson said that the Postmaster-General was not yet able to give precise dates for the opening of all the future television stations. The Sutton Coldfield station opened on the 17th December and it was hoped to open Holme Moss about the middle of 1951.

Nationalized Fuel Industries

Mr. Blackburn asked the Minister of Fuel and Power what changes were contemplated or had been made in the organization of research and development connected with the fuel industries since the nationalization of the coal, gas and electricity industries.

Mr. Gaitskell said the following changes had so far been made: The National Coal Board had set up its own Central Research Establishment, in which most of the industry's research would be done. The Board co-operated with other research organizations, including his Department's Safety in Mines Research Organization, the Fuel Research Station and the Pneumokoniosis Research Unit, and supported the British Coal Utilization Research Association, the Coal Tar Research Association and the British Coke Research Association.

The British Electricity Authority had taken over the research laboratory established by the Central Electricity Board, and supported the British Electrical and Allied Industries Research Association. The Authority co-operated also with the Department of Scientific and Industrial Research, the British Coal Utilization Research Association and other research associations.

The Gas Council had not yet decided its future organization of research, but was meanwhile supporting the Gas Research Board.

He (the Minister) had taken over the safety in mines research stations previously financed out of the Miners' Welfare Fund, and collaborated closely with the Medical Research Council on health researches. In addition, his Department was arranging for research and development work on a number of projects—such as the underground gasification of coal—which did not fall clearly within the field of any one of the nationalized industries. This work was under the direction of his chief scientist, appointed last year. He had also set up a Scientific Advisory Council, with a membership consisting of representatives of the nationalized industries as well as other scientists, to advise him on the scientific aspect of his statutory responsibilities, including the fulfilment of his functions in connection with the research programmes of the nationalized fuel industries.

Rural Supplies

Sir John Jarvis asked the Minister of Fuel and Power whether he would instruct the Central Authority to obtain a full report from all Area Boards of the progress which was being made in the supply of electricity to farms and cottages in rural areas; and of the steps they proposed to take to eliminate the present delays in that connection.

Mr. Robens said he would not. The reports of the British Electricity Authority and the fourteen Electricity Boards would be published next month and would give information on the progress made in rural electrification. Within the limits of their resources the Area Boards appeared to be making satisfactory progress in supplying electricity to farms and cottages in rural areas, having regard to the other priority connections which also had to be made. The cut in capital expenditure of the

Boards would largely fall upon the distribution side of the electricity supply industry and make an acceleration of rural electrification impossible in the immediate future.

Tax on Water Heaters

Mr. Ivor Thomas asked the Chancellor of the Exchequer whether, in his consideration of a reduction in the purchase tax on electric water heaters to the same level as the purchase tax on gas water heaters, he would bear in mind that the bulk of the heaters supplied were of the immersion type, which were the only type within the means of the general public; and whether he would give an assurance that any concession he made would extend to immersion heaters as well as thermal storage heaters.

Sir Stafford Cripps said that on the advice of the Minister of Fuel and Power, immersion water heaters were being excluded from the reduction because they contributed largely to the peak load.

Mines Report

General Conclusions from Study of Accidents

THE Ministry of Fuel and Power has just announced the availability of the report of H.M. Chief Inspector of Mines (Mr. A. M. Bryan) for the year 1947 together with associated reports for the South Western, North Eastern and Northern Divisions, the last three having been prepared by Mr. T. A. Rogers, Mr. C. W. Scott and Mr. R. J. Edwards respectively. Copies of these publications are obtainable from H.M. Stationery Office price 1s 3d each except the one concerning the North Eastern Division which is priced at 1s.

The Chief Inspector's report, for the first time since 1938, includes as an appendix the report of the Electrical Inspector of Mines (Mr. G. M. Harvey) for the same year, publication having been suspended during the war years. In the compilation of this report 819 inspections were made of which 275 were surface inspections, 272 covered both surface and underground plant and 272 were underground inspections only. In addition to these, 21 inspections were made at metalliferous mines and 366 at quarries, while 161 days were spent in attending inquests, fatal accident inquiries and conferences.

The increasing use of electrical equipment is shown by the fact that the installed capacity of electric motors rose by 4 per cent over the previous year's figure to 2,753,584 h.p., representing 33,288 motors on the surface and 44,039 underground.

There were five fatal accidents during the year, resulting in the deaths of 13 people, while 75 people were injured in the same period. Of the fatal accidents, all of which occurred underground, three were due to electric shock, one man being killed in each case. The other two were caused by the electrical ignition of firedamp, the first resulting in the death of a man and injuries to three others, while the second, at Barnsley Main Colliery, caused the deaths of 9 people and injuries to 20 others.

The non-fatal accidents, in which 52 persons were injured, totalled 48. Of these, 51 were due to electric shock and one to the ignition of oil vapour from a switch by an open light. There were also 10 fires and one ignition of firedamp, but none caused personal injury.

Trailing cables were responsible for four fatal accidents in which 12 persons were killed and for 5 non-fatal shock accidents and three fires. The General Regulation 131 (h) states that "Trailing cables shall not be dragged along by the machine when working," but this regulation is frequently contravened, resulting in the cable ends being pulled out of the machine plug. The explosion at Barnsley Main, which was caused by the chafing through of the insulation and screen of a five-core cable, substantiates the fact that a screened cable is not necessarily of any value as a protection against firedamp. The inspector states that since the N.C.B. took over there has been a noticeable improvement in the quality of both trailing cables and gate end switchgear being installed underground.

With reference to coal face lighting, the

report considers that the 110 V 18in and 24in fluorescent lamps with their low intrinsic brilliance, offer distinct advantages. Although they are less liable than tungsten lamps to cause ignition of gas when broken, there is still a danger due to the exposure of the small filaments at the ends if the tube is broken. It is therefore considered necessary to enclose the lamp in a flameproof fitting, but this involves difficult design problems. The fittings so far produced have not been certified as flameproof but have been approved for use in experimental installations under close observation. Where the position of fittings is permanent, however, and there is practically no risk of damage as in roadway lighting, fluorescent lamps have proved most effective.

During the past 18 years no less than 23.5 per cent of the total number of victims of fatal and non-fatal electrical accidents were electricians. A study of these accidents indicates that the cause in the majority of cases is the absence of fundamental training in the orderly, methodical approach to a job, the instinctive adoption of safety precautions and a refusal to be distracted by outside influences from concentration upon the work in hand. It is recommended as a remedy to this state of affairs that during the early part of their training underground apprentices should work under specially selected supervisors given the rank of inspectors.

The concluding section of the report deals with the distribution of electrical power below ground. The use of "flit-plugs" in conjunction with adaptors is strongly deprecated because although the arrangement may be very convenient it has led to many accidents. Another bad practice is the use of the same type of h.v. cable on both the h.v. and m.v. sides of a mobile transformer. This is very dangerous as when the cables are running side by side it is impossible to distinguish between them and mistakes are bound to occur to the detriment of all concerned. There is also likely to be serious overloading on the m.v. side. The only practical method of avoiding these practices appears to be the use of entirely different types of couplers for the two voltages, to avoid confusion and eliminate the possibility of a h.v. supply being connected to l.v. apparatus.

Education by Film

THREE more have been added to the educational films which are being produced by the British Electrical Development Association with the aim of giving the future citizens an understanding and appreciation of the nature of electricity and the services it provides in modern life.

Earlier films dealt with the generation and transmission of electric power, electrical circuits and various appliances. The third series explains electrical phenomena by means of animated diagrams and "shots" of experiments and applications. The first four already released are "What is Electricity?", "Electricity and Movement," "Putting Free Electrons to Work," and "A.C. and D.C."

The first of the three new ones is "Electricity and Heat." It illustrates the generation of heat by causing atoms to vibrate, explaining the nature of various conductors and dielectrics and their use in heating equipment from blankets to furnaces. This is followed by a film on "High-Frequency Heating," illustrating inductive phenomena and processes in a fascinating way. The third film is "Electro-Chemistry"; it lucidly explains what takes place in the charging and discharging of a secondary battery and the ionisation of metallic salts in a plating bath, etc., with illustrations of the process in actual use.

The commentary throughout (most of it being by Mr. F. A. Hoare) is clear and should be easily followed by intelligent senior boys and girls. It avoids the facetiousness which commonly ruins such films as these and is yet not without its lighter touches. The Association is doing well in producing this series and is admirably served by the principals and staff of Merton Park Studios, Ltd.

At a Press "pre-view" last week, after a few opening remarks by Mr. V. W. Dale, general manager and secretary of E.D.A., outlining the Association's film programme, Mr. Philip Honey (E.D.A.) introduced each film, explaining the aim in each case.

Commercial Travellers' Dinner

The festival dinner of the Royal Commercial Travellers' Schools is to be held at Grosvenor House, Park Lane, W.1, on 27th January. Mr. Leslie Gamage, M.C., president of the 1949 maintenance appeal, will be in the chair.

Power Station Strike

THE "unofficial" strike at four power stations came to an end on Saturday last. At Barking, where the men came out in protest at the use of troops to keep the Brimsdown, Taylor's Lane (Willesden) and Littlebrook stations running, there was a return on Thursday. On the same day the employees of the other three stations resolved to resume work but found that notices had been posted informing them that their return would be "unconditional." Thereupon they decided to continue the strike.

The British Electricity Authority declined to withdraw the notice and reiterated its determination not to enter into negotiations with the strikers' leaders. The Authority was not prepared to let it appear that the strikers had imposed any conditions upon their return.

On Friday, after discussion between the B.E.A. and representatives of the trade unions concerned, a new notice was drawn up explaining that resumption of work would take place on no other conditions than those existing before the strike, i.e., those agreed upon by the National Joint Industrial Council for the Electricity Supply Industry. This notice was accepted by the men: work was resumed by the Friday night shift at Brimsdown and Taylor's Lane and the Littlebrook men returned on the following morning.

During the four or five days of the strike the stations involved were kept running by the technical and clerical staffs with the help of Service men. As a result, and with the aid of the grid, the cuts in supplies which had to be made were not of a very serious character, although a great deal of inconvenience was caused in some districts.

Electric Vehicles

ON 13th December at the Royal Society of Arts, members of the Industrial Transport Association heard an interesting lecture on the "Battery Electric Vehicle" by Mr. H. W. Heyman, managing director of Smith's Electric Vehicles, Ltd., and chairman of the Vehicle Manufacturers' Committee of the Electric Vehicle Association of Great Britain, Ltd. Mr. Heyman's talk was preceded by a film on the subject, produced by the B.T.H. Co.

In covering a very wide field, Mr. Heyman particularly stressed the aspect of costs. In this connection he pointed out that over a thousand million gallons of milk a year was delivered to British housewives, costing in transport from dairy to point of delivery about 4d per gallon. In the course of a year this meant a bill of more than £15 million for this single item. Obviously, any saving on this figure must be worth while. Transport efficiency was therefore most vital, and this was where the electric vehicle was so valuable. Cutting the cost of the components of vehicles did not, however, lead to maximum efficiency, and did not pay in the long run. Quality in electric vehicles, as in most other things, did count.

Mr. Heyman advocated the allocation of the battery to running costs, so that it was treated as consumable over four years. In this regard attention was drawn to manufacturers' battery hire schemes, whereby a battery costing say, £200, could be paid for by four instalments of £50 spread over four years, without interest or other additional charges.

The very large number of questions asked in a discussion indicated the great interest that had been aroused.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents

Variations in Steel Conduit

MANUFACTURERS of steel conduit have been under a heavy handicap owing to their experiencing considerable variation in the analysis of steel they have been receiving.

Machines for making conduit are set up to deal with a particular type of steel which manufacturers of conduit do their best to obtain. When a variation in the analysis is experienced they immediately endeavour to make every adjustment possible in their own plant to accommodate it, but, in the case of steel being harder than usual, it is a matter for which they cannot provide any antidote through their own process of manufacture.

The demand for conduit and the supplies of steel have been such that, in order to meet requirements, manufacturers have been compelled to accept varying qualities of steel, but they continue to do everything possible to obtain supplies of steel of a suitable analysis which they know will give the bending and other qualities which they desire to supply in the tube they manufacture.

C. HARDEMAN SMITH,
Secretary,
Association of Steel Conduit
Birmingham, 2. Manufacturers.

Cable Eccentricity

An Electronic Gauge for Extruded Types

By F. E. PLANER *
M.Sc., Ph.D., A.C.G.I.

ECCENTRICITY of the conductor with respect to the surrounding dielectric has been one of the problems associated with the manufacture and examination of extruded cables insulated with rubber, p.v.c., polythene, etc.

To produce a concentric cable by the extrusion process and thereby avoid wastage of material, premature failure due to lowered insulation resistance, cross talk in telephone applications and reflections in v.h.f. cables, it has hitherto been necessary to examine rings of the insulating material cut from the cable at regular intervals. Apart from entailing the destruction of the sample, this method is particularly undesirable for production testing as it involves temporary stoppage of the extrusion process which, in turn, changes the temperature distribution at the die face of the extruder and hence alters the flow of the plastic insulating material—which constitutes the main cause of eccentricity.

It is difficult, therefore, to predict by normal methods, with any degree of accuracy, the adjustment of the die position required to correct for an observed deviation of the conductor from the cable axis.

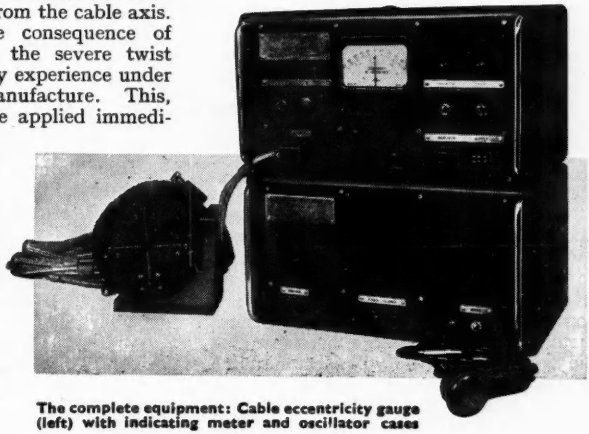
Another undesirable consequence of eccentric extrusion is the severe twist that the conductor may experience under such conditions of manufacture. This, useful tests have to be applied immediately at the exit of the extruding machine where the angular co-relation between eccentricity and die position are still maintained, thereby allowing the correct die adjustment to be assessed.

These difficulties can now be overcome by electronic measurement and control. The method is a continuous one; a meter indicates the degree of eccentricity directly while the cable is passed through a measuring device, either when finished or during manufacture. In the latter case the equipment may be employed to control the extruding machine automatically.

The principle is related to the method of determining the depth of a buried cable (*Electrical Review*, 8th July, 1949). In both cases a.c. is injected into the cable under test and the resulting electro-magnetic field is explored by means of inductive windings. However, while the latter serves to indicate the position of a conductor many feet distant, the range of the eccentricity gauge is restricted, and its accuracy is of the order of ± 1 mil, irrespective of the diameter of the conductor, the thickness of the insulation and the type of dielectric of the cable.

The equipment consists of three units: (1) a gauge head, through which the cable under test is passed, containing an astatic coil aggregate housed in a split

* Addison Electric Co., Ltd., London.



The complete equipment: Cable eccentricity gauge (left) with indicating meter and oscillator cases

cast-iron case, (2) an electronic indicator with control unit, and (3) an oscillator for the supply of the cable current. The last two items are housed in pressed-steel cases and interconnected by a cable; the third case also contains the common mains operated power supply.

In operation, the gauge head is mounted on the test bench in the laboratory, or when employed for the control of the manufacturing process immediately behind the die of the extruding machine with its engraved X and Y axes corresponding to the horizontal and vertical die adjustments, respectively. In the latter application, several gauge heads may be used in conjunction with a selector switch and a single indicator and oscillator to supervise a number of extruders simultaneously.

Method of Operation

One end of the cable to be tested is then connected through a slip-ring to the oscillator and the other end and one oscillator terminal are grounded. About 100 mA is thereby injected into the cable which, on completion of the loop, operates by relay a pilot lamp in the indicator, showing that cable current is flowing. The current is automatically stabilized and of a low frequency so as to keep the inductive reactance of the wound-up cable small; otherwise a dangerously high test voltage would have to be applied.

The e.m.f.s induced by the cable current in the windings of the gauge head are fed through screened connecting leads to the indicator, where they are combined, amplified, modulated and delivered to a 4in centre-zero meter calibrated directly in values of eccentricity. There are three pre-set sensitivity ranges. The most sensitive corresponds to full-scale deflections of ± 25 mils of eccentricity, the scale law being linear.

The measurements in the horizontal and vertical planes are made separately by setting an X/Y selector switch first to the one, then to the other position. In the case of a system for the automatic control of the extruder, each measurement is followed by the corresponding die adjustment, the X/Y selector switch being motor operated.

As the instrument indicates essentially the position of the conductor inside the gauge head with respect to the two engraved axes, the accuracy of the eccentricity measurement is independent of the overall diameter of the cable, depending, however, upon the accuracy with which the cable is guided through the head. Various systems of guiding may be employed, the use of solid split die inserts in the head probably being the simplest.

The amplifier is a four-stage negative feedback circuit incorporating an m-derived wave filter for the suppression of interference. The e.m.f. obtained from two of the coils (diametrically opposite on either side of the cable under test and connected in electrical opposition) is amplified and fed to a ring modulator. A phase corrected fraction of the oscillator voltage is also applied to the ring modulator, the output of which is d.c. whose voltage amplitude is proportional to the eccentricity of the conductor in the cable under test and whose sign corresponds to the direction of the conductor deviation. This direct voltage is fed to the indicating meter. When it is required to control the extruding machine automatically, a small polarized relay is incorporated in the meter circuit. It closes one of four control circuits, according to the sign and plane of the eccentricity measured, whenever the conductor deviation exceeds about 5 mils. The four control circuits may be employed either to operate warning lights or to control motors arranged to restore concentric extrusion automatically by operating die adjusting devices.

Calibration of the amplifier is carried out by pressing a push switch which causes a fraction of the oscillator voltage to be injected into the measuring circuit A given meter deflection should be obtained when the amplifier gain is correctly adjusted.

The author gratefully acknowledges the valuable assistance given in the development of the equipment described by Messrs. A. Bedford and T. Walford.

Fluorescent Lamp Operation

AT a recent meeting of the Illuminating Engineering Society in London, Mr. W. A. R. Stoyle and Mr. G. D. Jones-Thomas read a paper dealing with the operating characteristics of the different types of fluorescent lamps for the benefit of those who are concerned with maintenance and servicing.

Commerce and Industry

Duty-Free Machinery Imports

Public Speaking Challenge Shield

SINCE 1st July, 1945, it has been open to importers of machinery and accessories or parts of machinery to apply for a licence to import the consignment without payment of duty on the ground that similar machinery is not for the time being procurable in the United Kingdom. On 29th September, 1949, the Board of Trade announced the removal of import licensing restrictions (in the form of an open general licence) on imports into the United Kingdom of a wide range of goods, including many items of machinery and plant, from O.E.E.C. and other "soft-currency" countries.

Importers are now reminded that although separate import licences are not required for any machinery, parts or accessories covered by the 29th September arrangements, it will still be necessary to apply for a "duty-free" licence if it is desired to put forward a claim on the grounds mentioned in the first paragraph. Applicants for a duty-free licence should provide evidence of their intention to import by sending to the Board of Trade Import Licensing Branch (Duty-Free Section), 91, Victoria Street, London, S.W.1, copies of their order and the supplier's acceptance of the order, or invoice. Importers will be required to certify that the machines are for their own use; or, if they are acting as agents, to produce evidence that they have received firm orders from manufacturers who will use them.

Applications for duty-free licences are not considered for any consignment if the value for duty purposes of goods concerned is less than £100.

St. Dunstan's

The annual report of St. Dunstan's for the year ended 31st March last has just been published. This outlines some of the good work which is being done for men and women who have lost their sight as a result of war service. Training is given in various branches of industry and commerce and includes assembly, packing, and operating automatic machines, telephone operating, physiotherapy, shopkeeping and handicrafts. Much is also done for the general welfare of St. Dunstaners and their families. The report acknowledges the voluntary financial help received and appeals for continuation of donations, subscriptions and legacies.

Export Credits Guarantee Department

The Export Credits Guarantee Department announces that it has opened a new office at 14, Castle Street, Liverpool, 2. (Telephone: Liverpool Central 5756.)

B.T.H. Window Display

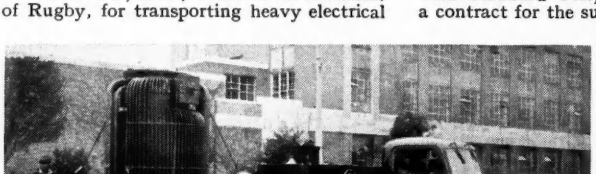
At Crown House, Aldwych, London, the latest B.T.H. window display, shown in the accompanying illustration, is on a domestic entertainment theme and makes a feature of "Mazda" projector lamps for home cinemas. A 16 mm B.T.H. sound-film projector is also shown, with an illusion that this is providing the source of a large-scale background picture on a topical winter sports subject. The rear and side walls of the window area are made to resemble the walls of a room at home, and are decorated by "Disneylights" at what would be approximately picture-rail height. These novelty lights are also to be seen on the

B.T.H. projector lamp window display at Crown House

Christmas tree in the window and are displayed in their attractive boxes in the foreground.

Trailer for Equipment Transportation

An 8-ton Commer-Hands tractor-trailer has recently been supplied to the British Thomson-Houston Co., Ltd., by Geo. T. Hilton & Co., Ltd., Commer distributors, of Rugby, for transporting heavy electrical equipment. The tractor incorporates a six-cylinder petrol engine developing 80 b.h.p., vacuum servo hydraulic brakes, and an all-steel cab, "Diaflex" mounted, whilst by means of the "J" type coupling gear, diverse types of trailer may be used, thus using one motive unit for a variety of jobs. The trailer, shown in the accompanying picture at the B.T.H. works, is so designed that machinery need only be lifted a few inches from the ground for loading purposes, whilst safe anchorage is assured by means of strategically placed ring bolts.



Eight-ton Commer-Hands tractor-trailer at B.T.H. Company's Rugby Works

E.D.A. Challenge Shields

Although for some time the feeling has been growing that some tangible recognition should be given to the winning of the national final of the E.D.A. public speaking competition, it was felt that additional money prizes would tend to create an undesirable spirit in the competition. The E.D.A. Council recently decided to solve the problem by authorizing the preparation of two challenge shields, one for the men's section and one for the women's section of the competition. These are to be known as the Faraday Shields, and they will be held for a year by the winners' Area Boards. In addition, the individual winners of the national final will be presented with a small plaque inscribed with name, date, etc.

The E.D.A. Council further ruled that the first holders of the Faraday Shields shall be the winners for 1948-49. The first names to be inscribed, therefore, will be those of Miss D. E. Wagstaff, Eastern Electricity Board, Barnet; and Mr. J. Spencer, North Eastern Electricity Board, Scarborough.

Broadcasting Transmitters for Egypt

The Egyptian Government has placed with Standard Telephones & Cables, Ltd., a contract for the supply of two high-power short-wave broadcasting transmitters. These transmitters, of a type similar to those used by the B.B.C., have two channels and an output power of 100/140 kW. They will operate in the 13/49 metre band. The broadcasting station building, situated at Abu Zabal, about 20 km from Cairo, is now under construction, and when installed, the transmitters will inaugurate the first high-power broadcasting service of the Egyptian administration.

E.C.A. Newcastle Dinner

At the annual dinner of the Newcastle-on-Tyne branch of the Electrical Contractors' Association, Mr. L. C. Penwill, director of the Association, stated that until political considerations were removed from industrial relationships this country could not hope to regain its former prosperity. The national president, Mr. S. Dickinson, said that despite many reverses the Association still had as its object a scheme for the compulsory registration of electrical contractors and operatives. Mr. V. Ferens, chairman of the branch, presided.

Import Restrictions Removed

Further electrical appliances will be free from export restrictions as from 5th January. Among them are: Drink mixers and parts; hair clippers and driers and parts; gas lighters and lighter elements; echo sounding apparatus; parts of the following domestic electrical appliances: blankets and pads, coffee percolators, fans, floor polishers, hairdressing appliances, irons, ironing machines, washing machines and wringers, kettles, electric toasters and vacuum cleaners; telegraph and telephone apparatus; watthour meters and parts thereof; laundering and dry cleaning machinery (including domestic machines); lifting, hauling, and transporting machinery; electroplating, tinning, galvanizing and similar processing plant.

Announcing this in the House of Commons on Thursday last week, the President of the Board of Trade, Mr. Harold Wilson, pointed out that these new relaxations were additional to those announced on 29th September and with those already in force would fully discharge our obligations under the O.E.E.C. decision of 2nd November.

Token Import Scheme

The Board of Trade has announced that the Token Import Scheme will be continued in 1950 on the same basis as in 1949. The token import annual quota will remain 20 per cent by value of each individual manufacturer's average trade in 1936-38 with the United Kingdom in the commodity in question. The countries participating in the scheme will be: Australia, Belgium and Luxemburg, Canada, Denmark, Finland, France, Holland, India, Italy, Norway, Pakistan, Sweden, Switzerland and the United States.

The list of token import commodities includes industrial porcelain insulators, carbon electrodes, electric light bulbs, electric light fixtures, electric switches, dry batteries (torch), dry batteries (high tension), electric meters, electric fans, complete with motors for domestic use, vacuum cleaners and parts, electric refrigerators for domestic use, and parts, and electrical equipment for cycles and motor cycles.

E.D.A. Annual Meeting

The annual general meeting and luncheon of the British Electrical Development Association will take place on 21st April next at the Connaught Rooms, Great Queen Street, London, W.C.2.

Window Display Competition

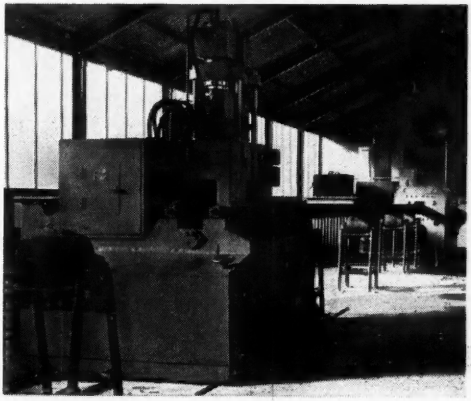
The Eastern Electricity Board recently organized a window display competition for service centres in its area. The final judging in this competition took place last week and resulted as follows:—Area first prize: tie between Romford and Palmers Green. Second prize: Hemel Hempstead. In other Sub-Areas the winners were Fens: Soham. Norfolk: Downham Market. Suffolk: Walton-on-the-Naze. In accordance with the terms of the competition the appliances shown in the windows were mainly those illustrated in the Board's Christmas gift leaflet, and were appliances that have little or no effect on the electricity peak.

Caroline Haslett Travelling Exhibition

On 15th December, Miss Elizabeth Gwillim, holder of the fourth Caroline Haslett Travelling Exhibition, gave a lecture at the Institution of Electrical Engineers on "The Reconstruction and Electrification of Holland," based on her recent visit to that country, in which she reviewed the progress which has been made by the electricity supply industry towards recovery following extensive war damage, and dwelt particularly upon domestic development and the work of organizations to popularize the domestic uses of electricity and to ensure the manufacture of efficient apparatus.

Railway Flash-butt Welding

In connection with developments at the Southern Region Permanent Way Works of the British Railways, at Redbridge, Hants, electric flash-butt welding equipment has been installed for welding rails end to end, thereby reducing the number of rail joints in the track. The plant, which has been designed and manufactured by AI Electric Welding Machines, Ltd., comprises a 350 kVA automatic flash-butt welder with clamping and upsetting mechanism operated by oil pressure, capable of welding track rails of 95 lb b.h. and 109 or 113 lb f.b. sections, and conductor rails of 100 or 150 lb sections, and an automatic electric post heater for normalizing the affected structure of the rail steel and equalizing variations of hardness in the running surface resulting from the welding process. A power-operated stripping machine will be fitted to the welder for rapidly removing the upset metal from the weld, leaving only a small amount to be ground off. A line of rollers extends from the rail bank on the input side of the welding shop, through



Electric flash-butt welding equipment for welding rails end to end recently installed at the Permanent Way Works of the Southern Region at Redbridge, Hants.

the shop and on to a rail bank 300ft long, from which the welded rails will be loaded by overhead travelling hoists. The layout of the shop is designed to enable one weld to be post-heated while the next weld is being made.

While the plant is primarily installed for the production of long welded rails, it will be used initially for welding short 113 lb rails into 60ft lengths. This will absorb a considerable number of short 113 lb rails which are at present on hand.

Trade Announcements

A. P. Lundberg & Sons, Ltd., have closed down their works in London and have removed to Credenda Works, Rood End Road, Oldbury, Birmingham.

The sales organization and Accounts Department of **Imp Radio, Ltd.,** are removing on 1st January to the company's works at No. 5 Factory, Upper Bristol Road, Bath (telephone: Bath 61179).

G. S. Peckham & Co., Ltd., have appointed Mr. F. H. Morris as their representative in the East London and Essex area, and Mr. R. H. Harper in the South-east London and Kent area.

G. P. Dennis, Ltd., of Liverpool, have opened a London office at 417, Grand Buildings, Trafalgar Square, W.C.2. (telephone: Whitehall 2920).

Mr. L. A. Roland, of 25, Herbert Gardens, Kensal Rise, London, N.W.10, has been appointed sales representative of **V. & E. Friedland, Ltd.,** Macclesfield, Ches., for Greater London, the Home Counties and East Anglia.

H. Fisher (Oldham), Ltd., has appointed the Compania Standard Electric Argentina (associates of Standard Telephones & Cables, Ltd.) as sole agents for Argentina and Paraguay; similar arrangements with other South American branches of the same concern are under consideration. Norsk A/S Philips (associates of Philips Electrical, Ltd.), have been appointed sole agents for Norway.

The London office of **Pinchin, Johnson & Associates, Ltd.,** is now at 4, Carlton Gardens, S.W.1 (telephone: Trafalgar 5600).

Mr. J. D. Harris has been appointed sales representative for Scotland and Northern Ireland to **Bill Switchgear, Ltd.,** and takes up his appointment on 1st January. Mr. Harris was formerly sales representative in Scotland for the General Accessories Co., Ltd., and before that was sales representative, first in Birmingham and later in the Midlands, for J. H. Tucker & Co., Ltd.

A new branch will be opened on 1st February by **Brown Brothers, Ltd.,** at Margaret Street, North Road, Preston, Lancs (telephone: Preston 4693), under the management of Mr. W. MacGregor.

G. H. Lucas & Co., 57, Princess Street, Manchester, 2, are now carrying stocks at Manchester and Altrincham for any urgent requirements in the trade for "E.D.L." adjustable lighting fittings, "Bermex" switch fuse gear, and "Danby" time switches.

Contracting Industry Agreements

The National Federated Electrical Association, Africa House, Kingsway, London, W.C.2, has published a new edition of the "Industrial Agreements and National Working Rules" booklet, the contents of which will comprise the Industrial Agreements Section of the 1949 E.C.A. Year Book, copies of which will be forwarded shortly to all members. Copies of the booklet are available at the price of 1s each to members and 2s 6d to non-members, post free.

Central London Accessories

The Minister of Fuel and Power has made the Electricity (Central London Electricity Accessories) (Transfer) Order, 1949 (S.I. 1949, No. 2288, H.M. Stationery Office, 1d). This transfers to the London Electricity Board all interest of the British Electricity Authority in the ordinary shares of Central London Electricity Accessories, Ltd., which was acquired by the B.E.A. on vesting day.

Plant Loading

In the article on "Economy Loading of Generating Plant" (*Electrical Review*, 9th December) the reference to Table III in line eight, second column, page 1097, should read "Running two machines incrementally loaded, i.e., from Table IV . . ."

Changes of Name

British Oil Engines (Export), Ltd., has changed its name to Associated British Oil Engines (Export), Ltd.

A new company, Associated British Oil Engines, Inc., 57, Park Avenue, New York, has been formed to operate as the American agents of Associated British Oil Engines (Export), Ltd., of London, and is to distribute the engines of Petters, Ltd., J. & H. McLaren, Ltd., Mirrlees, Bickerton & Day, Ltd., and the Brush Electrical Engineering Co., Ltd. The new company is a subsidiary of the Brush Company.

The Express Electrical Co. has changed its name to Express Powerlite Installations, Ltd.

The Provincial Incandescent Fittings Co., Ltd., has changed its name to Pifco, Ltd. The word "Pifco" has been its registered trade mark since 1902.

Electricity Supply

North Wales Canvass : Cheaper London Electricity

DELAYS in the scheme for the provision of electricity to rural areas were the subject of report at the meeting of North Wales Branch of the Rural District Councils Association at Wrexham. From the Merseyside and North Wales Electricity Board a letter was received stating that up to the end of June the occupiers of 5,000 premises had been canvassed, and of these 3,663 had agreed to take supplies of electricity as soon as it became available; 985 of the premises were farms, 2,300 private dwellings and 253 commercial premises. Construction had already commenced on several of the schemes where the necessary consent had been obtained, but, unfortunately, in some cases both local landowners and tenants and even the county authorities had held up the work either because they required the Board to lay underground cables, or they had some objection to the overhead line route chosen.

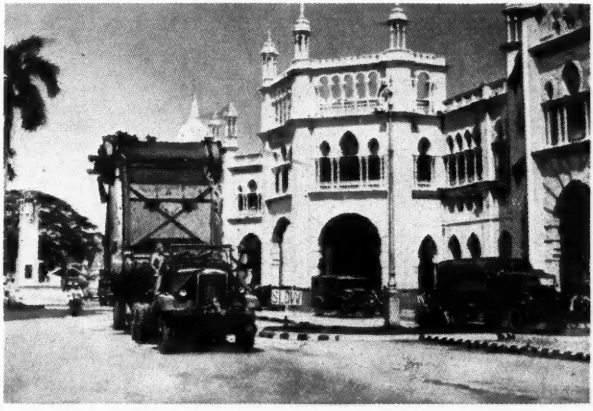
Rural Development in S.W.

Before the middle of next year the South Western Electricity Board is to start work on schemes to take electricity supplies to 6,370 premises, including nearly 1,000 farms, in rural areas. A broad outline of these schemes was given to the South Western Electricity Consultative Council at Torquay on 16th December. They are additional to the major work of augmenting and strengthening the high-voltage network, as well as the connection of new supplies in urban districts. The Board hopes the plans will not be affected by the cuts in capital expenditure, and will carry out the programme to the full extent of the construction capacity that can be made available.

A large proportion of these rural schemes are based on the first results of the Board's comprehensive survey, to be completed in the next two years, which will cover the whole of the south-west. The following are the approximate totals of rural schemes to be started in the counties of Somerset, Devon and Cornwall by mid-1950: Somerset, 531 farms and 2,426 other premises; Devon, 156 farms and 1,468 other premises; Cornwall, 265 farms and 1,524 other premises. These figures are based on the programmes of the Board's Sub-Areas, which do not entirely conform to the county boundaries. In the case of Somerset, a small area of Gloucestershire is included.

Rehabilitation in Malaya

Bandit activity, as well as delays in the delivery of material from the United Kingdom, limited the amount of work carried out by the Central Electricity Board, Federation of Malaya, on a number of important transmission schemes in hand last year. On the power plant side, however, the report of the Director of Electricity (Mr. F. P. Egerton) records considerable progress with preparations for the new Connaught Bridge steam station at Klang, for which the consulting engineers are Preece, Cardew & Rider. Until this project is completed it will be impossible to meet the heavy demands for industrial power in Selangor, especially from the tin-mining companies. Some improvement in output was achieved during 1948 following the completion of a good deal of rehabilitation



Thirty-two ton marine boiler for installation in the Bungsar Power Station, Federation of Malaya, passing the railway station at Kuala Lumpur

work and the installation of oil engine sets in a number of small towns. At Bungsar, the principal steam station, a new 65,000 lb/hr boiler originally intended for H.M.S. *Eagle* was brought into commission towards the end of the year and it was then possible to relax the restrictions.

The report of the consulting engineers on hydro-electric development was received during the year. It covers three separate schemes, namely, Cameron Highlands (two stages, 40,000 and 60,000 kW); Robinson Falls (800-1,000 kW); and Tranum River (700 kW).

Altogether the Board generated 124 million kWh, an increase of 21.4 million compared with the previous year. Sales amounted to 96.9 million kWh, of which 67.8 million kWh was consumed in Kuala Lumpur and district; this compares with 87.7 million kWh in 1940, the reduction being wholly due to the need to restrict supplies to dredges and open-cast mines.

Employment or Amenity ?

The matter of the proposed power station at Great Yarmouth was further debated at the last meeting of the Town Council. The Deputy Mayor (Councillor F. H. Stone) moved a resolution expressing the Council's regret at hearing that work on the station was unlikely to start before the middle of 1951, and asking the B.E.A. to reconsider its decision so that a much earlier start could be made, thereby relieving local unemployment and aiding national recovery generally. To this an amendment was successfully moved by Councillor H. S. Matthes calling on the Council to reaffirm its previous decision and to instruct the town clerk to write to the B.E.A. asking whether it was ready to inform the Council of its plans and satisfy the Council that it was able to provide the power station without injuring the town's amenities.

Freedom of Choice

Edinburgh Housing Committee on 13th December decided that when tenants of houses on two sites at Old Saughton move in they are to be given the choice of gas or electric cooking. The S.E. Scotland Electricity Board wrote pointing out that the average cost per house for installing mains services had worked out at £38 18s over nine estates, while the average annual revenue per house for the year ending 31st March last was only £4 10s. The housing executive officer, Mr. M. Murchison, said that at present where gas cookers were installed in homes this installation was taken into account when fixing the rent. The Corporation made no arrangements for fitting electric cookers. In reply to a question, he said that although he could not give the number of electric cookers at present in use in the 20,000 Corporation houses there was an appreciable number. Councillor J. B. Mackenzie, the chairman, said that this raised an important point of policy. At the moment the Corporation was prepared to supply gas cookers at no charge to the tenant, but tenants who wanted electric cookers had to make their own arrangements. He felt it should be the same for both.

London Charges Reduced

This week the London Electricity Board announced its intention of reducing all flat rates above 5d per kWh, or 5½d for supplies taken through prepayment meters, to those figures, and all secondary charges under domestic and commercial two-part tariffs, to ¾d per kWh. The reductions, which will take place after the meter readings for the December quarter, will affect 268,600 consumers in thirty-five districts. At the same time the Board issued a warning that it would be compelled, during the next few months, to raise certain of the lower flat-rate charges which were not now at an economic level.

Supply to Highest Village

On 6th December Colonel J. G. Crabbe, O.B.E., M.C., J.P., Lord Lieutenant of the County of Dumfries and a member of the South West Scotland Electricity Board, closed the switch which gave electricity for the first time to Wanlockhead. This is the last remaining village in Dumfriesshire, which is largely rural in character, to be connected to the supply network. Wanlockhead, situated at about 1,400ft above sea level, is the highest village in Scotland and the gradients over the whole section of line are such that all materials had to be dragged to the site by horses as even track vehicles were found to be impracticable. It is of interest to note that the h.v. line supplying Wanlockhead, which runs through the historical Enterkin Pass, also supplies a radar station at 2,377ft above sea level. The transformer for the radar station supply is a standard 100 kVA 3-phase pole-mounted unit, and is protected by 11 kV h.r.c. fuses and lightning arrestors. This is probably the highest pole-mounted transformer in Great Britain.

Bankside Cables

Southwark Borough Council reports that the British Electricity Authority is proposing to lay 60 kV transmission mains from Trafalgar Street junction with Dawes Street to Sumner Street, drawn into existing earthenware ducts; and from Sumner Street junction with Emerson Street to the Bankside power station, laid direct in the ground.

Improved Electric Trains

NEW LONDON TRANSPORT ROLLING STOCK FOR DISTRICT LINE

THE first post-war cars for use on London Transport's surface lines have now been delivered and will shortly be put into service on the District Line. In all 143 non-driving motor cars are being built by the Gloucester Railway Carriage and Wagon Co., Ltd., which is also converting 82 of the District Line trailer cars to driving motor cars. The trains are arranged for operation in formations of six or eight cars, although additional uncoupling facilities have been provided between the fourth and fifth cars of a six-car train for emergency use.

All cars are equipped with a self-ventilated nose-suspended 110 h.p. (one hour rating) motor in each bogie. Designed by Crompton Parkinson, Ltd., and the General Electric Co., Ltd., the motors are being made in equal proportions by these two companies and Metropolitan-Vickers Electrical Co., Ltd. Many improvements have been introduced as a result both of experience gained in operating the 1938 stock and experimental work which has been carried out. Fluorescent lighting is incorporated and the trackless air-operated sliding-doors are designed to prevent the sticking caused by obstructions which was experienced in the tracks formerly used.

Current-collection Gear

Apart from this, the bogies have been fitted with spring-borne shoegear mounted on insulated brackets carried on the bogie frame, the conventional shoebeam thus being eliminated. A compensating mechanism, related to a stop on one of the axleboxes, ensures that the shoe height in relation to the running rail is independent of the bogie frame height, whilst the balata straps which limit the drop of the shoes for this purpose enable all shoes on a bogie to be lifted from and maintained clear of the current rails by means of a capstan-type handle on the side of the bogie.

The electric traction equipment is of the P.C.M. type supplied by the British Thomson-Houston Co., Ltd., and is similar to that which has given excellent service on the 1938 tube stock. The master controller has two forward positions; No. 1 gives a reduced acceleration for conditions of wet or greasy rail which may produce wheel slip, and No. 2 the maximum acceleration. In the reverse position the lower acceleration is in use.

The trains will enter service arranged for a minimum field strength of 80 per cent, with which the performance of the train will conform closely to that of existing rolling stock. For future improvement weaker fields can be employed and provision has also been made in the control equipment to modify the control sequence so that 80 per cent field strength can be attained with the weak-field switch in the "off" position. With the weak-field switch in operation the final stage of field weakening would take place to the selected value.

Auxiliary Supplies

The auxiliary control gear for such items as compressor, motor generator, lighting, heating, etc., has been grouped together and housed in a separate equipment case. A dual purpose motor generator set is mounted on one car of each pair, together with a 46 V 56 Ah battery which floats across the generator. This machine has an output of 4 kW at 50 V d.c. for battery charging, emergency lighting, traction control and the operation of electro-pneumatic door and brake equipment. In addition, it supplies a.c. for the fluorescent lighting at 110 V 850 c/s from a winding inserted in slots in the main pole shoes of the generator.

The speed, and therefore the a.c. frequency together with the output voltages of the motor generator are held within close limits over a wide range of supply voltages by a vibrator type of regulator which is excited from the generator voltage and controls the machine speed through a 50 V winding on the motor field.

A motor driven compressor is fitted on the other car of each pair. The compressor is a two stage reciprocating type fitted with an intercooler and is capable of delivering approximately 34 cu ft of free air/min against a pressure of 120 lb/sq in. The compressors are synchronized by an electro-pneumatic system which ensures the cutting-in of all governers simultaneously. Each governor cuts out independently and the scheme as a whole is arranged for easy isolation of faults.

The new cars were built and the former trailer cars converted to designs prepared under the direction of Mr. W. S. Graff Baker, chief mechanical engineer (railways), London Transport Executive.

FINANCIAL SECTION

Company News — Stock Exchange Activities

Reports and Dividends

Tube Investments, Ltd.—Referring to the prospects of the electrical companies in the group at the annual meeting held on 14th December, Mr. I. A. R. Stedeford (chairman) said that the brightest feature of the electrical division had been its future prospects, for once more many difficulties and frustrations outside their control had prevented this division from making its fair contribution to the group's results. They had practically completed the involved task of production reorganization upon which they embarked over two years ago. The present indications suggested that the results of this division for the current financial year would not be unsatisfactory.

The home market was now highly competitive for all their products, although in the case of their Simplex installation material orders still kept well ahead of production. The Electricity Boards had assisted sales of cookers by offering hire purchase and in some cases simple hire terms to householders. They had shared in the advantages of this move, for about 25 per cent of the country's total purchases of electric cookers were "Creda" models manufactured by Simplex.

In the export market they increased their trade by over 30 per cent, despite the closing down of the South African market. Unfortunately in most of the overseas territories open to them electric power was in short supply, and any further considerable increase in exports of domestic electrical apparatus must therefore await a solution overseas of problems similar to those which faced consumers of electricity at home.

Electric & Musical Instruments, Ltd., held its annual meeting on 16th December, when Sir Alexander Aikman (chairman) in the course of his speech said that the company, in common with many others, was feeling the effect of the termination of the sellers' market. This did not mean that the volume of sales was falling, but the margin of profits was lower and the effect would be reflected in the accounts of the current year.

At the present time there were two successful television systems operating in the world, namely the electronic television camera equipment and the television modulation equipment. The two systems were respectively British and American in their origin, and the British system was developed in the research laboratories of their company. They had established the manfacture of cathode ray tubes for television receivers on a large scale at Hayes and in addition had purchased the ordinary shares of Electronic Tubes, Ltd., which had a plant at High Wycombe for the manufacture of cathode ray tubes and radio valves.

During the past year they had established two subsidiary companies for supplying broadcast relay services by wire, at Hayes and Harlington and Uxbridge, and their engineers had recently developed a successful method of supplying television by the same means. In the acoustic field they had had success with their new magnetic tape recording apparatus. They hoped shortly to place on the market new types of dictating machines. During the past few years they had specialized in the development of mobile radio equipment, including broadcast receiving apparatus for private motor cars. At least 75 per cent of the receiving equipment in British motor cars was supplied from E.M.I. factories through Radiomobile, Ltd.

Turner & Newall, Ltd., report a consolidated trading profit (less losses) for the year ended 30th September last of £7,572,283, as compared with £7,726,099 for the preceding year, and after providing for depreciation and making other appropriations there is a profit balance of £6,088,936 (against £6,822,893) to which is added income from investments, etc., of £185,143, making £6,274,079 (against £6,978,813). Taxation requires £3,574,585, and transfer to specific reserve against stock-in-trade is £600,000. The net balance for the year is £2,099,494 (£2,547,050) to which is added £779,144 set aside for taxation and no longer required. After making various provisions, it is proposed to pay a final ordinary dividend of 11¼ per cent, maintaining the distribution for the year at 15 per cent, less tax. The balance carried forward is £852,592, an increase of £372,678.

Ozonair, Ltd., proposes to issue 10,000 unsecured ten-year convertible note units of £1 each carrying interest at 5½ per cent per annum. The notes will be convertible into ordinary shares on 1st July, 1955, at holder's option at the rate of ten 2s ordinary for each £1 note unit held. After 1st July, 1955, the notes, if not converted, will be redeemable at 21s per £1 note unit up to 30th June,

1957, and at 20s 6d from 1st July, 1957, until the due date of redemption, 31st December, 1959, when such as are still outstanding will be due to be redeemed at par. Applications from shareholders must be lodged by 30th December next.

Morphy-Richards, Ltd., propose to capitalize £82,500 of existing reserves and undistributed profits by distributing to ordinary stockholders 1,650,000 1s ordinary shares in the proportion of three for every 1s ordinary stock unit held.

Enfield Cables, Ltd., is again paying an interim dividend of 3¾ per cent.

The London Electric & General Trust Ltd., has declared an interim dividend of 2 per cent (unchanged).

New Companies

H. Keeling & Sons (Derby), Ltd.—Registered 22nd October. Capital £5,000. Buyers, sellers and repairers of and dealers in wireless and television sets and components, electrical appliances and fittings, etc. Directors: A. Keeling and C. Keeling. Regd. office: 122, Pear Tree Road, Derby.

Rightway Electrics, Ltd.—Registered 11th November. Capital £300. Electrical engineers and general electrical installation contractors, etc. Directors: J. Wright and D. Wright. Regd. office: 161, Buslingthorpe Lane, Leeds, 7.

Telefusion (Vision), Ltd. — Registered 12th November. Capital £500. To construct, erect, set up and maintain wireless signal and other stations, etc. Directors: J. C. Wilkinson and Constance M. Wilkinson. Regd. office: 11, Nicholas Street, Burnley.

Kinley Neon, Ltd. — Registered 10th November. Capital £100. Neon light tube manufacturers and fitters, etc. Directors: F. C. Wodward and F. Copley. Regd. office: Commercial Union Buildings, Cheapside, Nottingham.

Holland House Electrical Co. (Belfast), Ltd.—Registered in Belfast 11th November. Capital £7,500. Directors: G. W. Hamilton, J. H. Dunlop, A. S. Wraight and A. Glenister. Regd. office: 2, Alfred Street, Belfast.

Electric Services (Garston), Ltd.—Registered 12th December. Capital £1,500. Electrical, mechanical and general engineers, etc. Directors: W. Hope and Mrs. Mary Hope. Regd. office: 26, Window Lane, Garston, Lancs.

North End Electrical Co., Ltd.—Registered 23rd November. Capital £1,500. Radio and electrical contractors, etc. Directors: V. A. Baron and R. McKillen. Regd. office: 203, North End Road, W.14.

Household, Domestic & Electrical Appliances, Ltd.—Registered 12th December. Capital £500. Wholesale and retail dealers in and manufacturers of vacuum cleaners, electrical appliances, radio instruments, etc. Directors: H. Sutherland, 25, Lambourne Gardens, E.4, and F. R. Prosser, 20, St. Catherine's Road, E.4.

Geo. Kesterton, Ltd.—Registered 10th December. Capital £100. Electrical contractors and engineers, electricians, etc. Directors: G. A. Kesterton and M. Pointing. Regd. office: 22, Scotland Street, Ellesmere, Salop.

Increases of Capital

Colston Electrical Co., Ltd.—Increased by £16,000 in £1 shares, beyond the registered capital of £4,000.

Osborne & Hunter, Ltd.—Increased by £5,000 in 2,500 ordinary and 2,500 undenominated shares of £1 each, beyond the registered capital of £10,000.

Wilkins & Mitchell, Ltd.—Increased by £50,000, in £1 shares, beyond the registered capital of £60,000.

Horace Green & Co., Ltd.—Increased by £80,000, in £1 shares, beyond the registered capital of £20,000.

John M. Millar, Ltd.—Increased by £165,000, in £1 ordinary shares, beyond the registered capital of £10,000.

Bradford Electrical Services, Ltd.—Increased by £10,000 in £1 ordinary shares, beyond the registered capital of £5,000.

Winding-up Petition

Stamford Electrical, Ltd.—In the Winding-up Court on 12th December Mr. Justice Vaisey had before him a petition for the compulsory winding up of Stamford Electrical, Ltd. The petition was for a judgment debt of £61 for goods sold and delivered. There were five supporting creditors. The company asked for an adjournment for six weeks, and his Lordship adjourned the petition till 23rd January.

Liquidations

Ilkeston Assisted Wiring & Electrical Appliance Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. G. Lee, 5, East Street, Ilkeston.

Salisbury Transformer & Electrical Co., Ltd.—Meeting 18th January at the registered office of the company to receive an account of the winding-up by the liquidator, Mr. A. T. Burden.

Bankruptcies

O. C. Walden, formerly carrying on business at Hinckley Road, Leicester, under the style of Hall & Frith, radio and electrical dealers.—Receiving order made 9th December on a creditor's petition.

FINANCIAL SECTION
STOCKS and SHARES

THE quietude of Stock Exchange markets is rarely ruffled by any approach to activity in the fortnight before the close of a year. The present time offers no exception to the general rule. However reprehensible (if natural) "window-dressing" is, it continues to be a deciding factor in a good many cases where people have money at the bank which they might feel disposed to invest, were it not for tradition.

Week's Price Changes

Cable & Wireless ordinary spurted 14½ points to 252 on a fair amount of buying on behalf of investment which took the view that as the scheme recently defeated would, if carried through, have given the stockholders at least 242, the fact of its rejection implied that proprietors will get something still better under the new scheme which the directors are preparing. The 5½ per cent preference remains dull at 99.

Amongst the radio shares which have improved, Electric & Musical show a gain of 1s 6d, at 18s. Cossor, 9s, are also 1s 6d up; E. K. Cole at 17s have risen a florin; Pye deferred at 31s 3d are 2s 6d better on the week. Scophony at 3s 7½d, Ultra Electrics, 3s 9d, are others that have strengthened. English Electric are steady at 42s 6d. Decca keep about 12s 6d. In the manufacturing group, Johnson & Phillips at 60s 9d are the pence better; Ericssons at 38s 9d have risen 6d. Laurence, Scott, at 13s, held their recent rise. In the dollar group, International "Tel. & Tel.", after reaching 20, went back to 19.

British Electric Traction deferred is quoted ex the rights, of two for one. The "A" non-voting stock is 500 and the "B" (carrying votes) 495, the two together being practically the same price as before, allowing for deduction of the rights. Another ex-rights price is that for Ward & Goldstone, which is now 36s 3d.

Tube Investments' Reserves

Mr. I. A. R. Stedeford had a remarkably strong balance-sheet to present to last week's annual meeting of Tube Investments. In distributing by way of dividend barely a quarter of the net surplus, the company retained no less than a million and a half in the business. With other accretions, total reserves have now reached the impressive total of over £23 million. After deduction of the preference capital this is still practically seven times the amount of ordinary stock in issue. The chairman spoke well of progress in the group's electrical departments. A reaction in the price of the shares to £5⅞ is attributed to his reference to prospects in the bicycle section of the business. The yield is 4¼ per cent.

Telegraph Construction

Another sizeable line of electrical equipment shares is available in Telegraph Construction & Maintenance £1 ordinary at 37s. Since the payment of the usual 10 per cent dividend for 1948 (when group earnings were equivalent to 35 per cent on the single-class capital of £782,000) shareholders have received, free, a 25 per cent capital bonus. A proportionate adjustment of the dividend rate would reduce the payment to 8 per cent. On that basis, the yield is £4 6s 6d per cent. The last balance sheet was notable for net liquid assets of £1.3 million, and this year's capitalization of reserves leaves the company still well equipped in that respect.

London Electric Wire

Since the shares come comparatively seldom to the market in any large numbers, mention may be made of a useful line of London Electric Wire & Smiths £1 ordinary currently on offer at 44s 6d. They give a yield of just under 4½ per cent on the 10 per cent dividend paid for the last three years. The last report, issued in June, showed a notable expansion in the group's net profit, which, at £347,000, was practically double the previous figure, and dwarfed the £54,000 net distributed in the parent company's preference and ordinary dividends. General reserves, together with the carry-forward and a £150,000 dividend equalization reserve, were thereby raised to over £2 million. Capital consists of £684,000 in ordinary and £400,000 in 7½ per cent preference stock.

Preference Shares and Premiums

English Electric's 3¾ per cent preference shares are among the few first-class securities in this category which can be bought below par. On offer now at 18s 3d, they yield £4 2s 3d per cent. This compares satisfactorily with the return afforded by many of the 4 per cent issues standing at about par. Others which can be bought free of the suspicion which recent High Court decisions have thrown upon preference shares include G.E.C. 4¼ per cents at a few pence over 20s; Hackbridge & Hewittic "fours" at 18s 6d; Enfield Cables 4½ per cents at 21s; and Telephone Rentals 4½ per cents at 20s 3d.

The Year's Progress

General Electric Co., Ltd.

SHIPMENTS of electrical goods to overseas markets in 1948/49 by the General Electric Co., Ltd., represented an advance of 313 per cent on the 1938 figure.

Included among work in hand for overseas are five 30,000 kW turbo-alternators for the Orlando power station, Johannesburg, which will raise the ultimate capacity to 337,500 kW. Pass-out turbo-alternators are being built for four industrial establishments in this country.

Three 25,000 kW vertical shaft hydro-electric alternators are on order for the Tungatinah power station, Tasmania, as well as sets for Tanganyika and the Government of Orissa. Thirty motor-driven compressors are in course of construction for home and overseas customers, while engine-driven generators for export include twenty-eight sets for the Williamson diamond mines, Tanganyika, and the Assam Railways.

Oil-immersed and airbreak switchgear is being supplied to the Government of Nagpur, Berar, India, and the Uganda Electricity Board. Outdoor circuit breakers for tropical use now employ heaters in the oil tanks and mechanism housing for service under monsoon conditions.

A new range of standard cubicles built on the unit principle (for control boards, high- and low-voltage switchboards and contactor panels) of flat panels, not requiring framework, can easily be made dustproof and readily extended. A fuse-operated circuit breaker has been designed for over-current protection when 5 or 10 kVA has to be taken from high-voltage bus-bars.

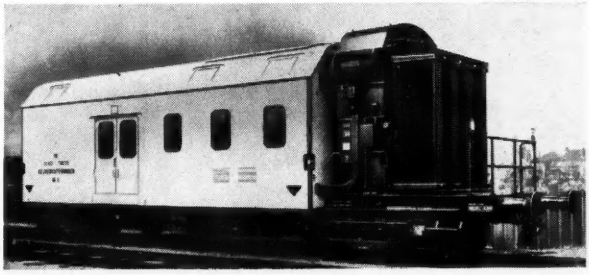
Power line chokes are being built for carrier telecommunication equipment, connected in the actual power line, to block off high-frequency energy from those parts of the system where it is not needed and also to form part of a filter coupling the h.f. system to the power line.

Six 70,000 kVA 11.8/140.7 kV generator transformers and a like number of 45,000 kVA 132/33 kV units are in hand for the British Electricity Authority. Export orders include six of 16,000 kVA for 6.6/138 kV for Spain and one of 40,000 kVA for Palestine.

Mercury rectifiers with additional anodes for energizing the fields of d.c. motors are in increasing demand for variable speed drives; they are supplying power for a cogging mill belonging to John Baker and Bessemer, Ltd., while 20,000 kW of apparatus of this type is also being built for the B.E.A. power stations at Accrington and Uskmouth. A 12-anode air-cooled steel tank pumpless type has been introduced for 12-phase rectification.

A compact 110 kW at 10 kV rectifier for the B.B.C. has a new design of glass-to-metal seal. A 1,200 kW at 1,500 V mobile equipment for the Netherlands Railways is in commission and a further contract for sixteen more of the same rating is in hand.

The 1,350 h.p. and 1,750 h.p. geared a.c. winders for the Welsh Navigation



One of seventeen 1,200 kW at 1,500 V mobile rectifiers made for the Netherlands Railways

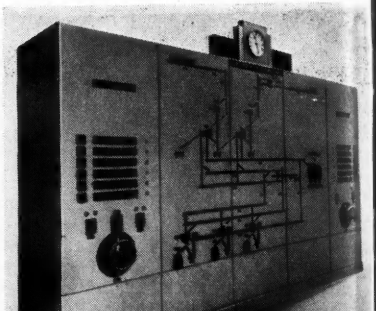
and Calverton Collieries have been put into commission. The range of flame-proof motors has been further extended. Coal preparation plant for the Nantgarw colliery embraces the complete coke-handling plant and the electrical equipment for gas-producing and by-product plants. At the Mansfield colliery preparation plant motors aggregate 2,400 h.p. and are under centralized control from twenty-six stations; the entire sequence of operations is reproduced on a mimic diagram board. Among orders for preparation plants for South Africa is an installation for Schoongezicht with a capacity of 375 tons an hour; another is an extension for the Cornelia colliery and a third is for a new coal area, South Rand.

An electrical control scheme for coke handling and screening plant built for the Indian Iron & Steel Co. by Simon Carves, Ltd., permits the desired flow to be set up on the control board; the appropriate parts of the diagram are then illuminated, enabling the operator to check the arrangement before he presses the button which starts conveyors, crushers and so forth automatically in the correct sequence.

Much of the electrical equipment for the Steel Company of Wales has been delivered, including more than 1,000 d.c. mill-type motors as well as mercury arc rectifiers. Six rectifier transformers nearing completion are so designed that two equipments in parallel will give equivalent 24-phase operation. Further contracts include a 1,000 h.p. slab squeeze motor, a 300 h.p. crop shear motor and roller table motors, and the electrical equipment for two skin pass mills.

For the Scunthorpe works of Richard Thomas and Baldwins, Ltd., a 5,000 h.p. cogging mill drive and a 3,000 h.p. Ilgner set are on order. For the conversion of a Cluster Bliss mill to a strip mill at the Brierley Hill works there are being supplied two 800 h.p. reel motors, a 650 kW motor generator set, a 100 kW drag generator and two boosters. The newly designed a.c. variable speed ring spinning frame commutator motor is already in service in a cotton mill at Misr-el-Dawar, Egypt.

Following the ninety-four trolley buses for Belfast Corporation, now in service, similar equipment has been built for seventy-five buses for Cardiff Corporation, of which twenty-five are already in service. For Launceston and Hobart, Tasmania, twelve further equipments have been ordered by the chassis makers, British United Traction, Ltd. The first model of an entirely new form of electric brake for trolley buses is being installed for trial on a Reading Corporation bus.



Illuminated mimic diagram "flow" control board for Indian coke handling and screening plant

Equipment for 40 main line locomotives for the South African Railways is now in course of construction. Heavy duty 1,500 V contactors for locomotives of hourly ratings well in excess of 1,000 h.p. have been designed. Repeat orders for ninety-four motors for surface stock for the London Transport Executive has been received and for fifty-four additional motors for the Northern line. A number of 2-bogie, 4-axle, diesel-electric shunting locomotives are on order for the Ceylon Government.

For the single-screw oil tanker *San Silvestre* of the Eagle Oil Shipping Co., Ltd., now in commission, complete electrical equipment, including propulsion, was supplied by the G.E.C.: similar equipment for a sister ship is in hand. The main generators, plural starting equipment and engine room auxiliary motors have been supplied for the Blue Star liner M.V. *Melbourne Star*; similar gear is being built for four further ships of the same owners. Plural starting gear is also to be used in the P. & O. liners *Himalaya* and *Chusan*.

The Witton and Fraser & Chalmers works are being extended.

NEW BOOKS

Radio-Frequency Heating Equipment. By L. L. Langton, A.M.I.E.E. Pp. 196; figs. 95; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 17s 6d.

This book has the sub-title "With Particular Reference to the Theory and Design of Self-Excited Power Oscillators," so the central part is devoted to valve circuits, power supplies and the various circuit arrangements required for dielectric and eddy-current heating. In addition, the two introductory chapters describe the principles and elementary theory of dielectric and eddy-current heating; the last two give examples of applications of these processes.

The treatment is simple and mainly descriptive, but sufficient theory is introduced to enable calculations of the various parameters to be made. The book is, on the whole, readable, clear, and gives a well-balanced treatment, but the reviewer finds some difficulty in deciding to what readers it should be recommended. To those who use r.f. heating equipment it will certainly be useful, but they may not find the valve sections of much interest. To radio technology students, also, it will prove useful, although they would probably prefer more details of applications. The equipment designer, however, will scarcely find the book sufficiently advanced for his purposes.

Although the descriptive part is satisfactory, the theory and examples are much less so. There are quite a number of careless errors and mis-statements, which will be irritating to the expert and confusing to the student. Energy and power are sources of continual confusion; for example: "If the energy dissipated is W watts, that dissipated per cycle is W/f joules" (p. 180); "power loss per second" (p. 18). Spruce wood certainly does not weigh $\frac{1}{2}$ lb/ft^3 (p. 157) and, even if we assume that $\frac{1}{2}$ g/cm^3 is intended, neither one cubic foot nor one cubic centimetre will form the sheet 4ft^2 by $\frac{1}{8}$in used in the problem. The use of the symbol ϵ for electric field strength and for permittivity is a most unnecessary departure from standard practice. The author will be well advised to check all his examples before a further printing is made.—H. R. L. L.

Hydraulics and the Mechanics of Fluids. By E. H. Lewitt, Ph.D. Eighth edition. Pp. 630; figs. 290, index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 21s.

First published in 1923, this well-known text-book has now reached its eighth edition. This is not necessarily a measure of the merits of a book as it is often the case that new editions tend to cling too much to out-dated information. This charge is not laid against Dr. Lewitt's book, however, since the many developments in the application of the fundamental theories underlying the mechanics of fluids have been progressively incorporated. The result is that with each edition, the book has grown in size even as it has grown in value. Thus, the development of the combustion turbine has drawn attention to the importance of a knowledge of the flow of gases in the design of the compressor.

A new chapter has been added on this subject including the use of the heat-entropy chart for the solution of problems on air flow, orifices and nozzles. The chapter on the design of aerofoil blading has been rewritten and applied not only to the axial flow air compressor but also to water turbines of the propeller type, while work has been added on supersonic flow and on the frictional resistance of rough surfaces.

In case it might be thought that the book tends to lean too heavily on the side of the mechanics of gases, it should be pointed out that all the theories necessary for a complete understanding of the fundamentals of hydro-electric power schemes are included, together with brief descriptions of modern water turbines.

In addition to being a deservedly well-recommended text-book for the university degree, the Higher National Certificate and the Professional Institution examinations in this subject, it can be

studied with advantage by all electrical engineers who are interested in water power and the combustion turbine.—A. R.

Books Received

Steam Turbine Operation. By W. J. Kearton, D.Eng., M.I.Mech.E., M.Inst.N.A. Fifth edition. Pp. 435; figs. 258; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 25s.

An Advanced Treatise on Physical Chemistry. Volume I. Fundamental Principles. The Properties of Gases. By J. R. Partington, D.Sc. Pp. 943; figs. and index. Longmans Green & Co., Ltd., 6/7, Clifford Street, London, W.1. Price 80s.

Wireless Simply Explained. By R. W. Hallows. Pp. 255; figs. 111; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 10s 6d.

Cathode Ray Tube Traces. By H. Moss, Ph.D., A.M.I.E.E. Pp. 66; figs. 52. Electronic Engineering, 28, Essex Street, London, W.C.2. Price 10s 6d.

Technique of Radio Design. By E. E. Zepler, Ph.D. Second edition. Pp. 394; figs. 283; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 25s.

Exports from Canada

CANADA'S electrical exports during the first half of 1949 declined by about 30 per cent on the corresponding period of 1948, the respective values being $6,530,000 compared with $9,172,000. The principal items exported in January to June this year are shown below together with notes of increases or decreases compared with the first half of 1948. It will be seen that exceptions to the decline were batteries, radio receiving sets, dynamos, transformers and meters and that there were noteworthy extensions of business in Latin American markets.

Canadian manufacture of electric refrigerators, according to an official report from Ottawa, has been firmly established and is capable of further expansion. Total value of production last year was $37,414,000 compared with $27,908,000 in 1947 and only $7,905,000 in 1938. Exports in 1948 totalled $1,981,000 in value against $794,000 in 1947. More than 22 countries provide custom for the Canadian electric refrigerator manufacturing industry, the most important in 1948 being South Africa.

It is now believed that refrigeration subassemblies or parts have a better long-range prospect in export than have complete units. The industry has been largely developed along American lines and a substantial proportion of the parts have been imported from across the border. Some Canadian firms manufacture under an agreement with United States concerns. There are few subsidiaries of British firms in the Dominion and relatively little equipment is being imported from the United Kingdom. The trend is definitely towards the manufacture of refrigerators with a large proportion of Canadian materials and components.

Class and Destination	Jan.-June 1949 $000	Inc. or dec. on Jan.-June 1948 $000
Batteries and parts	376	+ 141
To British Malaya	172	+ 87
,, Indonesia	161	+ 181
Radio receiving sets	788	+ 417
To S. Africa	111	+ 74
,, Philippines	94	+ 94
,, Venezuela	158	+ 130
Radio apparatus, other	771	— 140
To United Kingdom	133	+ 96
,, China	96	— 2,421
,, Sweden	140	+ 118
Dynamos, generators and pts.	657	+ 80
To Australia	16	— 1
,, Brazil	552	+ 234
,, Cuba	26	+ 1
Motors and pts.	1,004	— 600
Transformers and pts.	220	+ 65
To Venezuela	15	+ 11
,, Mexico	102	+ 91
,, Bermuda	17	+ 11
Meters and pts.	1,115	+ 321
To Brazil	137	+ 73
,, Chile	81	+ 21
,, Colombia	72	+ 26
,, Cuba	182	+ 72
,, Mexico	357	+ 212
Electric cookers	207	*
To South Africa	76	
,, Eire	72	
Telegraph and telephone apparatus	39	— 56
To Bermuda	11	+ 11
,, Honduras	5	+ 5
,, Cuba	4	—
Spark plugs, magnetos, etc.	283	— 416
To S. Africa	91	— 124
,, New Zealand	32	+ 28
,, Australia	23	— 14
,, S. Rhodesia	19	+ 18
,, Mexico	25	+ 50
Electrical apparatus, n.o.p.	425	— 231

* Comparative figures not available.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) may be obtained from the Patent Office, 25, Southampton Buildings, W.C.2.

1943

13644. Sperry Gyroscope Co., Inc.—High-frequency electric-discharge tube structures. 3rd August, 1942. (632913.)

20871. Philips Lamps, Ltd., and Nemet, A. A.—X-ray apparatus. 13th December, 1943. (632914.)

20872. Philips Lamps, Ltd., Nemet, A. A., and Bayfield, W. A.—X-ray apparatus. 13th December, 1943. (Addition to 632914.) (632915.)

1944

6380. Philips Lamps, Ltd., and Gray, W. R.—X-ray apparatus. 5th April, 1944. (632916.)

11125. Sperry Gyroscope Co., Inc.—Electrical phase responsive circuits. 25th May, 1943. (632776.)

16717. General Electric Co., Ltd., Veevers, J. F., and Thomas, J. F.—Electrical indicating meters. 1st September, 1944. (632777.)

1945

11846. Sueur, R. C.—Telephonic transmission systems using multiple channel-carrier currents. 25th November, 1943. (632778.)

15543. British Thomson-Houston Co., Ltd.—Electric-discharge devices such as discharge lamps. 19th June, 1944. (632917.)

18930. British Thomson-Houston Co., Ltd., Maggs, A. H., and Choudhury, S. U. A.—Operation of a polyphase electric motor from a single-phase source. 24th July, 1945. (632918.)

19225. Williams, F. C., and Moody, N. F.—Wireless signalling systems. 26th July, 1945. (632779.)

22034. M-O Valve Co., Ltd., and Ramsay, H. T.—Gas or vapour filled thermionic discharge devices. 27th August, 1945. (632984.)

25848. British Thomson-Houston Co., Ltd.—Gearing. 6th October, 1944. (632919.)

27225. Homrighous, J. H.—Television apparatus. 17th October, 1945. (632921.)

28584. Marzin, P., and Sueur, R.—Electrical carrier-wave signalling systems. 28th April, 1943. (632780.)

34476. Power Jets (Research & Development), Ltd., and Feilden, G. B. R.—Construction of rotors for compressors, turbines and like machines. 19th December, 1945. (632923.)

1946

4484. Philips Lamps, Ltd.—Devices comprising an incandescent-cathode rectifier. 11th April, 1941. (632987.)

4796. Sperry Gyroscope Co., Inc.—High-frequency electron-discharge tube structures. 3rd August, 1942. (Divided out of 632913.) (632924.)

4797. Sperry Gyroscope Co., Inc., and Stevens, A. H.—High-frequency electron-discharge apparatus. 20th August, 1943. Convention date not granted. (Divided out of 632913.) (632925.)

5089. Telegraph Construction & Maintenance Co., Ltd., Jones, F., and Cordrey, A. J. W.—Connectors for high-frequency cables. 18th February, 1946. (632926.)

8184. Standard Telephones & Cables, Ltd.—Radio beacon receivers. 26th March, 1945. (632784.)

13027. International Combustion, Ltd., Poole, F., and Bawden, E.—Electric welding. 30th April, 1946. (632991.)

16765. Patelhold Patentverwertungs- & Elektro-Holding Akt.-Ges.—Multi-channel communication transmission with modulated impulses. 10th April, 1946. (632788.)

20241. Standard Telephones & Cables, Ltd., and Brown, A.—Electric potentiometers and remote supervisory systems. 6th July, 1946. (632930.)

21533. Philips Lamps, Ltd.—Coated welding rods. 23rd April, 1942. (632931.)

21673. Black & Decker Manufacturing Co.—Cup-shaped rotary brushes. 4th August, 1945. (632792.)

21674. Black & Decker Manufacturing Co.—Rotary brushes. 4th August, 1945. (632793.)

21970. Kesselring, F.—Electric circuit-breakers. 7th August, 1945. (632794.)

23005. British Thomson-Houston Co., Ltd., Woodfield, T. H., and Morton, C. J.—Mounting of shaft bearings. 1st August, 1946. (Addition to 620566.) (632711.)

37770. Western Electric Co., Inc.—Rectifiers and methods of making them. 29th December, 1945. (632942.)

1947

813. British Thomson-Houston Co., Ltd.—Control of electric blankets or the like. 9th January, 1946. (Cognate applications 814/47, and 815/47.) (632943.)

2636. Treweek, K. H.—Electrical regulating systems. 28th January, 1947. (632999.)

2890. Westinghouse Electric International Co.—Electron-discharge devices. 21st September, 1943. (632948.)

3738. Metropolitan-Vickers Electrical Co., Ltd., and Chisholm, A. W. J.—Measurement of surface roughness. 7th February, 1947. (632852.)

3829. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Recording and reproduction of oscillations. 23rd December, 1943. (633000.)

3862. Holophane, Ltd. (Holophane Co., Inc.).—Luminairs. 10th February, 1947. (632807.)

4383. Siemens Electric Lamps & Supplies, Ltd., and Aldington, J. N.—Fluorescent electric discharge-lamps. 14th February, 1947. (632950.)

5155. Woods of Colchester, Ltd., and Birtwell, W. G.—Ventilating fans. 21st February, 1947. (632809.)

6459. Standard Telephones & Cables, Ltd., and Richards, A. E. J.—Mounting arrangements for electrical apparatus. 7th March, 1947. (632856.)

6460. Standard Telephones & Cables, Ltd., and Wright, F. C.—Mounting arrangements for electrical apparatus. 7th March, 1947. (632857.

6461. Standard Telephones & Cables, Ltd., Wright F. C., Delamere, A. C., and Richards, A. E. J.—Mounting arrangements for electrical apparatus. 7th March, 1947. (632858.)

7700 and 7703. British Thomson-Houston Co., Ltd.—Polysiloxanes. 21st March, 1946. (632954/5.)

9548. Berthiez, C. W.—Rheostats. 24th April, 1946. (632960.)

9748. Heiss, H.—Female jack element for use with electrical plug and jack terminal devices. 20th January 1947. (632815.)

10863. General Electric Co., Ltd., and Ollerenshaw, C.—Carrier transmission systems. 23rd April, 1947. (633007.)

11929. Scophony, Ltd., and Cook, G. H.—Kinematographic projection with continuously moving film. 2nd May, 1947. (Addition to 589971.) (632817.)

12238. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Photo-electric cells. 15th December, 1944. (632962.)

12649. British Thomson-Houston Co., Ltd.—Mass spectrometers. 11th May, 1946. (632963.)

12685. Berridge & Co., Ltd., I. L., Martin, C. S., and Cooke, A. E.—Snap-action switches and other snap-action mechanisms. 10th May, 1947. (632862.)

14346. O'Shei, W. E.—Double-throw electric switches. 29th May, 1947. (632715.)

15959. British Thomson-Houston Co., Ltd., and Roxburgh, A.—High-voltage electrical switching devices. 17th June, 1947. (632718.)

15970. English Electric Valve Co., Ltd., Young, A. J., and Colvin, R.—Vacuum-tight metal-to-glass seals. 17th June, 1947. (632971.)

16314. Clark, C. W.—Fittings for tubular lamps. 20th June, 1947. (632720.)

16671. Londex, Ltd., Smith, W. H., and Ireland, L. A.—Electrically operated burglar alarm systems. 24th June, 1947. (632721.)

17030. Watson, C. D., and Read, F. W.—Electrically driven power transmission systems. 27th June, 1947. (632723.)

17602. Telefonaktiebolaget L. M. Ericsson.—Electromagnetic relay especially for telephone plants. 5th July, 1946. (632976.)

17651. Pye, Ltd., Lawrence, N. Q., Germany, L. W., and Babbs, C. H.—View finder for television cameras. 4th July, 1947. (632726.)

19784. Metropolitan-Vickers Electrical Co., Ltd., and Carr, L. H. A.—Dynamic braking of induction motors. 23rd July, 1947. (632831.)

21077. Sylvania Electric Products, Inc.—Electric glow-discharge relays. 11th December, 1944. (632741.)

21085. Sylvania Electric Products, Inc.—Grid cutting and forming machine. 14th June, 1945. (632,742.)

21458. Sylvania Electric Products, Inc.—Holders for electric-discharge lamps. 28th February, 1946. (632743.)

21478. United Insulator Co., Ltd., and Chlumecky-Bauer, A. J. P.—Articles made by coating dielectrics by metallizing. 6th August, 1947. (632834.)

22081. Sylvania Electric Products, Inc.—Apparatus for sealing glass envelopes. 26th August, 1946. (632746.)

22347. Hannah, E. T. G.—Electric heating and cooking stoves. 12th August, 1947. (632747.)

22789. Stone, G. H.—Low voltage electric soldering iron. 15th August, 1947. (633020.)

23021. First Industrial Corporation.—Contacts for electric switches. 12th September, 1946. (632750.)

23269. Marconi's Wireless Telegraph Co., Ltd.—Electrical capacitors and apparatus for making same. 22nd August, 1946. (632752.)

23817. British Insulated Callender's Cables, Ltd., Crook, R. A., and Atherton, R. H.—Reels. 28th August, 1947. (632838.)

24573. General Motors Corporation.—Control for electric motors. 20th November, 1946. (632840.)

27017. General Motors Corporation.—Refrigeration apparatus. 2nd November, 1946. (632765.)

28187. Birmingham Sound Reproducers, Ltd., and McDonald, D. M.—Sound reproducing apparatus. 21st October, 1947. (632883.)

28888. Soc. de Prospection Electrique (Procedes Schlumberger).—Measuring instruments, relays and the like apparatus. 29th October, 1946. (Cognate application 28889/47.) (632769.)

29950. Broadbent & Sons, Ltd., T., and Hallitt, W.—Motor-driven centrifugal machines. 11th November, 1947. (632889.)

30695. Standard Telephones & Cables, Ltd., and Scully, C. T.—Two-way electric pulse communication systems. 19th November, 1947. (632892.)

30804. Pestarini, J. M.—Variable-speed electrical power plant such as for vehicle lighting systems. 20th November, 1946. (633035.)

30805. Pestarini, J. M.—Electric fluorescent lighting systems. 20th November, 1946. (633036.)

31303. Standard Telephones & Cables, Ltd., and Scully, C. T.—Two-way electric pulse communication systems. 26th November, 1947. (632893.)

31550. Standard Telephones & Cables, Ltd.—two-way radio communication system. 13th December, 1946. (632895.)

31791. Schaufelberger & Co. Solis Apparatefabrik, Dr. W.—Electric multiple switches. 5th June, 1940. (633037.)

31849. Marconi Instruments, Ltd., and Willis, D. R.—Radio and other high-frequency power measuring arrangements. 2nd December, 1947. (632899.)

32035. Standard Telephones & Cables, Ltd.—Receiving arrangements for multi-channel electric pulse communication systems. 27th July, 1946. (632901.)

32331. Barrett, J.—Reciprocating electric motors. 8th December, 1947. (633039.)

32489. Flight, T. N., Wilson, W. H., and Chinn, A. J.—Electric thermostats. 9th December, 1947. (632904.)

33076. Bellow, A.—Electrically driven cloth cutting machines. 16th December, 1947. (632905.)

33153. British Thomson-Houston Co., Ltd.—Glass compositions. 18th December, 1946. (632906.)

34247. Victor Products (Wallsend), Ltd., and Mann, R. W.—Switch-operated electric lighting and signalling systems. 24th December, 1947. (632909.)

1948

789. Stivin, J.—Heating heads for heating articles by induced electric current. 10th January, 1947. (633045.)

1949

2751. British Thomson-Houston Co., Ltd., Woodfield, T. H., and Morton, C. J.—Mounting of shaft bearings. 1st August, 1946. Divided out of 632711. Addition to 625266. (632772.)

7679. Kesselring, F.—Current limiters for direct and alternating current mains. 7th August, 1945. Divided out of 632794. (632843.)

10160. Western Electric Co., Inc.—Methods of treating germanium material. 29th December, 1945. Divided out of 632942. (632980.)

Discharge of Effluents

STRENGTHENING of the law by considerable revision of the Rivers Pollution (Prevention) Act, 1876, has been advocated by a sub-committee of the Central Advisory Water Committee in a report (H.M. Stationery Office, 1s 8d by post) which it has just presented to the Ministry of Health.

The main recommendation is that effluents discharged into rivers and streams (presumably including power station condenser cooling water) should be required to conform to standards, not uniform but varying according to the state of each river or part thereof, to be prescribed by by-laws to be issued by the administrative Boards which are now being appointed under the River Boards Act, 1948, on a catchment basis instead of for local government areas.

It is also recommended that the new Boards should have power to control new openings for effluent discharge and that they should be notified of changes proposed in existing discharges.

Other recommendations concern the deposit of solid matter in rivers, discharge of heated effluents, legal proceedings and supplementary powers.

Steam Water Testing

TESTS for water used in steam generation, Group A control tests not made in laboratory, are specified in B.S.1427, which is the first part of a series of publications dealing with the treatment of boiler water. Group B will include laboratory tests, and Group C will deal with special tests of investigation purposes. The main purpose is to ensure uniformity of method and in manner of expressing results. Copies are available from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 7s 6d post free.

CONTRACT INFORMATION

ACCEPTED TENDERS AND PROSPECTIVE ELECTRICAL WORK

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Australia.—BRISBANE.—27th January. City Council. Supply of 30,000 10A watthour meters. (C.R.E. (I.B.) 36408/49. Ten/833.)*

2nd February. City Electric Light Co., Ltd. Electrical instruments, control gear and panels. (C.R.E. (I.B.) 36374/49. Ten/836.)*

Brazil.—PORTO ALEGRE.—6th January. Comissão Estadual de Energia Eletrica, Rio Grande do Sul. Distribution equipment for use at Forquilha, Ijuisinho, Saltinho, Irai and Touros, including transformers, lighting arrestors, etc. (C.R.E. (I.B.) 36268/49. Ten/840.)*

RIO DE JANEIRO.—10th January. Director-General of the National Railway Department. Equipment for power station at Candiota, including four water tube boilers, two 10,000 kW turbo-generators, substations, etc. (C.R.E. 35426/49. Ten/828.)*

Chester.—6th February. City Council. Electrical installation in county secondary modern school, Hardbridge. (See this issue.)

Gosport.—30th January. Borough Council. Electrical goods for one year to 31st March, 1951. Borough surveyor, Town Hall.

New Zealand.—WELLINGTON.—24th January. Public Works Department. Two diesel/compression ignition oil engine-alternator sets for Hinatarge radio station. (C.R.E. (I.B.) 35266/49. Ten/835.)*

Portsmouth.—City Council. Electrical installation at Paulsgrove Primary School. (16th December.)

Southport.—3rd January. Borough Council. Installation of electric lighting in 220 houses at present lit by gas, Central Avenue and Guildford Road estate. Borough surveyor, Town Hall.

Orders Placed

Carlisle.—Corporation. Electrical installations in 40 houses under erection at Harraby, 34 at Upperby and 2 at Raffles (£1,921).—G. Graham, Carlisle.

Durham.—County Education Committee. Electrical installation at the Jarrow Bilton Hall Infants' New County School (£819).—Morris and Smiles.

Luton.—Corporation. Electrical installations in connection with conversion of Nos. 63-69, Guildford Street to form office accommodation (£2,027).—R. J. Stearn & Sons (Luton), Ltd.

London.—L.C.C. Electrical installation at Blackheath Road School, Greenwich.—London Electricity Board.

Newcastle-on-Tyne.—Regional Hospital Board. Electrical work for proposed outpatients' department at Berwick Infirmary (£280).—Stewart and Young.

City Council. Supply of 120 cast-iron lamp standards and swan neck brackets.—Revo Electric Co.

Installation of electric heating at the Brinkburn Street Sun Ray Clinic (£132).—Falconar Cross and Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Airdrie.—Houses (110), Wester Craigneuk East; J. Taylor, town clerk, 51, Wellwynd.

Alnwick.—Houses (30), for R.D.C.; Reavell & Cahill, Lloyd's Bank Chambers.

Atcham.—Houses for R.D.C.; C. R. Jones, The Orchard, Monkmoor Road, Shrewsbury (8 houses), and W. Higley & Son, 8, Pride Hill Chambers, Shrewsbury (6 houses).

Ayr.—Houses (175), Craigen Farm estate; Scottish Special Housing Association, Ltd., 15, Palmerston Place, Edinburgh, 12.

Barking.—Flats (48), Longbridge Road; borough architect.

Belper.—Houses (30), Holbrook; J. Milward & Sons, Market Place.

Billingham-on-Tees.—Additional classroom at the county school and modern school; G. R. Clayton, county architect, Court Lane, Durham City.

Bollington.—Houses (124), Bollington Cross estate; U.D.C. surveyor.

Bexley.—Houses, Halcot estate (112) and Glenmore estate, Welling (86); borough engineer, West Lodge, Broadway, Bexleyheath, Kent.

Birkenhead.—Houses (400), Prenton Village Road; N. Griffiths & Co., Grainger Avenue.

Factory, Bridge Street; Mackie & Gladstone, Ltd., 86, Hamilton Street.

Brighton.—Houses (70), Parkside and Lower Bevendean; borough surveyor.

Factory, Hollingbury estate; Brush Crystal Co., Ltd., 49, Clerkenwell Green, E.C.1.

Bristol.—Block of shops and offices, Broadmead and Union Street; city architect.

Broughton (North Wales).—Additions and alterations to Broughton Institution, for Welsh Regional Hospital Board; W. Griffiths, deputy county architect, Llwynegrin, Mold.

Burton-on-Trent.—Kitchen and dining room, Victoria Road boys' school; borough surveyor, Town Hall.

Bury.—Houses (50), Littlewood No. 3 site; borough engineer.

* Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1. Victoria 9040.

Ipswich.—School, Whitton area (£75,005); borough surveyor, Town Hall.

Jarrow.—Flats (84); borough architect.

Keighley.—Offices, workshops, garages, canteen, etc., at proposed new cleansing depot; borough architect.

Kettering.—Infants' and junior school; Frank Hickman & Son, Market Harborough.

Lancashire.—Adaptations at Sedgwick House, residential school, Kendal (£26,841); Nicholson & Wright, Ltd., Lancaster.

Leyland.—Houses (60) and 20 flats, Broadfield estate; F. D. Howe, surveyor, Council Offices.

Liverpool.—Houses (512), Speke estate; Unit Construction Co., Ltd., 113, Bentham Drive.

London.—CAMBERWELL.—Flats (156) in four blocks, Champion Hill, for L.C.C.; Guy Morgan & Partners, architects, 3, Upper Mall, W.6.

LEYTONSTONE.—Rebuilding bakery, Harrow Road; H. W. Nevill, Ltd., Acton Lane, W.3.

SOUTHWARK.—New building for Borough Polytechnic, Thomas Doyle Street; Humphreys, Ltd., builders, Knightsbridge, S.W.7.

Ludlow.—Primary school; Hobbiss & Hobbiss, 36, Waterloo Street, Birmingham.

Luton.—Boiler house and switch house; Vauxhall Motors, Ltd., Kimpton Road.

Houses (24), Farley Hill estate; R. Colin Large, Ltd., 119, Park Street.

Manchester.—Houses.—H. Jones, Buxton (17); A. Wallwork, Ltd., Stretford (76); F. Marsland, Stockport (51); Marsden & Chapman, Ltd., Timperley (84); Humphrey Park Estates, Ltd., Urmston (66); and W. H. Matthews, Ltd., Sale, Ches. (50).

Merton & Morden.—Flats (144), in 17 blocks, junction of London Road and Central Road, Morden; H. May, clerk to U.D.C., Morden Hall, S.W.19.

Newcastle-on-Tyne.—Two hostels for old people on Montague estate; G. Kenyon, city architect, 18, Cloth Market.

Houses (267), Fairway estate; city architect.

Northolt.—Secondary modern school, Eastcote Lane (£262,170); C. W. Radcliffe, clerk to Middlesex E.C., Guildhall, Westminster.

Norwich.—Houses (156) and 52 flats, Sandy Lane and Cooper Lane; John Cochrane & Sons, Ltd., builders, 39, Victoria Street, S.W.1.

Nottingham.—Fire station at Hodsock Langold; county architect, Shire Hall.

Oswaldtwistle.—Day nursery; G. Noel Hill, county architect, Preston.

Plymouth.—Houses (100), Whitleigh site; city architect.

Primary school, Ernesettle; Louis de Soissons & Partners, architects, 11, The Crescent.

Portsmouth.—New offices, Guildhall Square area (£20,000); secretary to the local Chamber of Commerce.

Richmond (Surrey).—Houses (50), Ham; borough engineer.

Richmond (Yorks).—Houses (20), Scorton; architect to R.D.C., Council Offices.

Romford.—Houses (40), Masefield Crescent, Eastern Avenue; A. S. Wilson & Partners, 8, Princes Street, Storey's Gate, Westminster, S.W.1.

Runcorn.—Houses (10), at Helsby; A. J. King, Rural District Council Offices, Frodsham.

Ryton-on-Tyne.—Houses for aged persons; T. Charlton, surveyor, U.D.C. Offices.

Scarborough.—Factory, Seamer Road, for Quartons, Ltd.; Alderson & Allen, architects, St. Nicholas Street.

Skelmersdale.—Houses (38), Windrows Farm site; J. L. Mather, surveyor, Town Hall.

Steyning. — Secondary modern school (£109,500) for West Sussex E.C.; Hoad & Taylor, Ltd., builders, Horsham.

Stourbridge.—Houses (156), Wollaston Farm estate; G. N. Maynard, architect, Town Hall.

Stretford.—Printing works, 336-340, Chester Road; J. Galt & Co., Ltd.

Swindon.—Houses (92), Moredon; John Laing & Son, Ltd., builders, Bunns Lane, N.W.7.

Thornliebank.—Factory F. A. Macdonald & Partners, architects, 3, Woodside Crescent, Glasgow, C.3.

Tynemouth.—Secondary technical school; G. H. Gray, architect, 52, Camden Street, North Shields.

Uxbridge.—New municipal offices, hall, etc. (£450,000); H. E. G. Stripp, surveyor, 263, High Street.

Wallasey.—Kitchen and dining room, Lingham county primary school; R. F. B. Grundy, borough engineer.

Walsall.—Factories for local industries; M. E. Habershon, borough engineer, Council House.

Watford.—Houses (50), Bushey Hall Farm estate; South Midlands & Greater London Housing Society, 30, Fitzroy Square, W.C.1.

Wednesfield.—Houses (24), Perry Hall estate; A. H. Lawrence, surveyor, 29, Bolton Road.

West Bromwich. — Factory, Birmingham Road; Tool Treatments, Ltd., 1, Hall Green Road, Stone Cross, Staffs.

Block of 18 flats, Florence Road; Albert Bye, Simms & Gifford, architects, 323, High Street.

West Ham.—Flats (60), Rokeby Street; borough architect, 70, West Ham Lane, E.15.

West Hartlepool.—County school with domestic science rooms; S. M. Richmond, borough architect, Municipal Buildings.

Whitley Bay.—Houses (12), Seatonville estate, for the U.D.C.; Rockcliffe Building Co., builders, Park View.

Wigan.—Primary school, Pemberton; Unit Construction Co., 21a, Brook Street, Knutsford, Cheshire.

Winchester.—County secondary school, Romsey Road (£148,000); county architect, The Castle, Winchester.

Woking.—Houses (48), Maybury estate; H. P. Tame, surveyor, Urban Council Offices.

Woodford.—Flats (40), Hermitage site, for Wanstead and Woodford; F. J. Coxhead (Leytonstone), Ltd., builders, 15, Martin Street, E.15.

Worsley.—Flats and shops; L. T. Broome, surveyor, Town Hall, Walkden.

Worthing.—Workshops and Stores, St. Dunstan's Road; A. G. Patley, 58, The New Broadway.

Houses (110), Maybridge estate; Gorham (Contractors), Ltd., 4, The Crescent, Goringby-Sea.